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DISSERTATION

Evaluating Cadet Leadership Position at the U.S. Air Force Academy

Jeremy M. Didier

This document was submitted as a dissertation in September 2012 in partial fulfillment of the requirements of the doctoral degree in public policy analysis at the Pardee RAND Graduate School. The faculty committee that supervised and approved the dissertation consisted of Larry Hanser (Chair), Chaitra Hardison, and Dave Sacko.

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ABSTRACT

The U.S. Air Force relies on effective leadership to complete its mission. The U.S. Air Force Academy exists to develop leaders of character for the Air Force through a four-year program. Part of this program involves cadets participating in leadership positions. By exploring nine types of cadet leadership positions, this dissertation aims to assist the Academy in assessing the value of admission criteria, awarding leadership positions, and designing leadership position experiences. Informing decisions in these areas is likely to improve the Academy's ability to develop effective leaders for the Air Force.

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GLOSSARY, LIST OF SYMBOLS, ETC.

Symbol	Definition
AAS	Athletic Activity Score
ACT	American College Test
ADLS	Advanced Distributed Learning Service
ADR	Active Duty Regular
AETC	Air Education and Training Command
AFCW	Air Force Cadet Wing
AFCW/CC	Air Force Cadet Wing Cadet Commander
AFCWI	Air Force Cadet Wing Instruction
AFDD	Air Force Doctrine Document
AF-EIM	Air Force Enterprise Information Management
AFSC	Air Force Specialty Code
AFTR	Air Force Training Records
ALO	Academy Liaison Officer
AMC	Athletic Merit List Count
AME	Average Marginal Effect
AOC	Air Officer Commanding
AUSLS	Air University Strategic Leadership Studies
BCT	Basic Cadet Training
CAP	Civil Air Patrol
CFA	Candidate Fitness Assessment
CIC	Cadet-In-Charge
CPME	Cadet Professional Military Education
CST	Combat Survival Training
CY	Class Year
DDT	Directed Development Time
DoD	Department of Defense
GPA	Grade Point Average
HSL	Honor Society Leader

HSM	Honor Society Member
IG	Inspector General
JROTC	Junior Reserve Officer Training Corps
LTC	Lieutenant Colonel
MCQ	Military Call to Quarters
MPA	Military Performance Average
NAAS	Non-Athletic Activity Score
NCO	Noncommissioned Officer
ODS	Officer Development System
PAR	Prior Academic Record
PEA	Physical Education Average
PITO	Personal, Interpersonal, Team, Organizational
ROC	Receiver Operating Characteristic
ROTC	Reserve Officer Training Corps
SAMI	Saturday Additional Morning Inspection
SAT	Scholastic Assessment Test
SDO	Squadron Duty Officer
SQ/CC	Squadron Commander
USAFA	United States Air Force Academy
USAFA/CW	United States Air Force Academy Cadet Wing
YR	Year

1. Introduction

Leadership has occupied the minds of great thinkers since antiquity (McLean and Weitzel, 1991, p. 31). In the first book of his *Politics,* Aristotle (1992, p. 363) argued that a natural division exists between rulers and the ruled with some "suited to rule and others to being ruled." Machiavelli (1992, p. 507) devoted a whole chapter of *The Prince* to discussing factors that cause rulers to be praised or censured. In 1793 George Washington (2007, p. 13) wrote that "The true distinction…between what is called a fine Regiment, and an indifferent one, will ever, upon investigation, be found to originate in, and depend upon the care, or the inattention, of the Officers belonging to them."

Today, leadership is viewed within the U.S. Air Force as a critical determinant of mission success. The 15th Air Force Chief of Staff, General Ronald Fogleman (2001, p. 39), noted how mission success or failure often depends on individual leaders. In a profession where success can be a synonym for life and failure can be a synonym for death, the stakes for effective leadership are exceptionally high.

According to Tyson and White (2008), recent failures of leadership at the highest levels in the Air Force contributed to blunders in nuclear weapon transport, inadvertent sale of classified technology, and nepotism in contracting. The Secretary of Defense responded to these failures by simultaneously firing the Chief of Staff and Secretary for the first time in history. The potential for disastrous consequences from such failures highlights the critical importance of effective leadership for the U.S. Air Force. Warren Bennis (1989, p.144) argued that effective leaders are most needed at the point when trust in leaders has fractured.

The Air Force's most recent doctrine document on leadership includes officers and enlisted service members as part of the "Air Force leadership team" (AFDD 1-1, 2011, p. 4). Air Force Pamphlet 35-49 asserts that effective leaders are important at all rank levels in the Air Force (Carver, 1985, p. 10). Although leadership is important at

all levels, the Air Force expects officers to "shoulder" leadership responsibilities (AFDD 1-1, 2011, p. 4). As a result, having effective leaders in the officer corps is especially important for mission performance.

General Thomas Richards (2001, p. 223) translated the importance of military leadership into an imperative for action: "Leadership is a vital part of today's Air Force; therefore, we cannot depend on born leaders-we must build them through formal training and progressive levels of responsibility." Like the other military services, the Air Force uses an "up or out" system and relies on within-organization promotion to fill senior positions (Fallesen et al., 2011, p. 469; Edwards and Morrison, 1994, p. 69). This organizational structure highlights why building leadership competence should be a top Air Force priority: The senior Air Force officers of tomorrow are the cadets and junior officers of today. In a speech given to ROTC cadets at Duke University in January 2012, Chairman of the Joint Chiefs of Staff General Martin Dempsey singled out developing leaders as the most crucial task for the U.S. military in a time of shrinking budgets (Pellerin, 2012).

In order to develop leaders effectively and efficiently, it is necessary to understand the impacts of current leader training programs. U.S. service academies are authorized to operate large-scale training programs for their respective braches of the U.S. military.[1] The Air Force Academy supplies approximately 20% of the Air Force officer corps with an annual budget of roughly $370 million for the purpose of "educating, training, and inspiring men and women to become leaders of character," yet members of the Academy's supervisory board are concerned that defining and measuring leadership capacity at the Academy lacks scientific rigor (Elliot, 2011; Air Force Academy Mission Statement, 2012, Air Force Academy Board of Visitors, 2009, p.4). This

[1] According to Title 10 of the U.S. Code, service academies' authorized maximum strength is 4,400.

dissertation responds to this concern in part by providing an analytic evaluation of cadet leadership positions.

RESEARCH SCOPE

This dissertation examines three aspects of the Air Force Academy program:

1. The selection process to become an Air Force Academy cadet
2. The selection process to hold a cadet leadership position
3. The association between holding a cadet leadership position and promotion as a commissioned Air Force officer

Academy cadet leadership positions are official positions of authority with specific leadership responsibilities. Cadet leaders are responsible for interacting with cadet subordinates in order to achieve assigned missions. For example, one responsibility of a cadet squadron commander is to ensure the highest morale, welfare, and safety of the cadets in the squadron (AFCWI 38-101, p. 73). The different types of leadership positions and their responsibilities are detailed in the section titled "Air Force Academy Development Program" in chapter 2.

Leadership at the Air Force Academy can be studied from many different angles. Research could focus on academic leadership classes, mentor relationships, leadership seminars, or other topics. I chose to study cadet leadership positions in this dissertation for three reasons:

1. **Cadet leadership positions help define leadership at the Academy by providing a concrete context.** The responsibilities and tasks associated with cadet leadership positions define what leadership means in practice at the Air Force Academy. By focusing on the context provided by cadet leadership positions, thinking about cadet leadership can move from nebulous concepts to concrete concepts. For example, instead of thinking about cadet leadership as something unspecific like "a leader motivates subordinates to achieve a purpose," focusing on the context of cadet leadership positions can shift thinking about cadet leadership to something more concrete like "the cadet wing

commander motivated the wing academic officer to decrease the amount of noise during official study periods by showing him complaints from freshmen cadets."

2. **Cadet leadership position participation is easily quantifiable from the records maintained by the Academy.** The quantification of leadership position participation is simple but provides a lot of information about the kind of leadership training a cadet received. This quantification of leadership training enables scientific examination using regression methodology.
3. **The impact on promotion of participating in each leadership position type can be empirically tested.** Leadership position types vary on many dimensions such as duration of authority and assigned responsibilities. Cadets do not participate in every leadership position type, so it is possible to compare the effect size of each position type relative to other effect sizes. It is not possible to perform this kind of comparison for programs all cadets experience such as the core academic leadership class or the leadership seminars. Examining the association between holding a leadership position and officer promotion must account for the possibility that the group holding leadership positions differs in important ways from the group not holding leadership positions. For example, cadets with high performance scores at the Academy may participate in one leadership position type at a higher rate than cadets with low performance scores. Since this dissertation's primary interest is the developmental value of holding a leadership position, it is important to account for selection differences between the position types. This dissertation employs a methodological approach capable of accounting for these selection differences.

While understanding the association between holding a cadet leadership position and officer promotion is an important part of this dissertation, informing the decision of whom to admit to the Academy

and of whom to assign leadership positions is also important. Working with a team of researchers to answer how good companies become great companies, Jim Collins (2001, p. 41) concluded that successful corporate leaders "first got the right people on the bus and then figured out where to drive it." Similarly, Air Force leaders must choose members for the Air Force team who will help the organization meet its mission. This bus metaphor becomes a tangible reality at the Air Force Academy where entering cadets are loaded onto buses at Doolittle Hall and driven to the entrance of the cadet area for the start of basic training. How does the Air Force Academy ensure the right people get on these buses? And, once the right people get on the buses, whom should be chosen as cadet leaders? Military organizations are unique in that they select and train people specifically for the jobs they perform, rather than selecting people with a previously acquired skill set and placing them directly into a job requiring that skill set (Guion, 2011, p. 12). This fact places a great responsibility on military administrators to design both effective selection and training programs.

POLICY OBJECTIVES

This dissertation seeks to ultimately improve officer leadership effectiveness by informing Academy admission decisions, cadet leader selection decisions, and training program design decisions. If the Academy admits individuals with important leader characteristics, awards leadership positions to a subset of these individuals who demonstrate leadership ability and potential for growth, and designs these leadership positions with responsibilities that have positive empirical associations with officer promotion, officer leadership effectiveness is likely to improve.

Identifying the admission information that significantly predicts participation in a cadet leadership position can benefit the Academy admissions department in its evaluation of applicant profiles. If cadet leadership positions are awarded based on meritorious past leadership

performance and an assessment of leadership potential,[2] the Academy admissions department should expect a relationship between the leadership measures considered for admission and participation in that leadership position type. If no such relationship exists, the admissions department may consider reevaluating applicant measures of leadership. The admissions department may also consider reweighting admission factors according to the strengths of the relationships found.

Determining the populations for which Academy leadership positions are most beneficial will yield recommendations for how to award leadership opportunities. For example, if cadet leadership positions are most developmental for cadets who have experience serving in the military prior to entering the Academy, it may be useful to include this information in the evaluation of cadet leader candidates. Application of findings such as this will require finesse from decision makers who likely want to maintain a selection process based on merit while also ensuring effectiveness.

Determining the associations between types of cadet leadership positions and officer promotion will reveal which types of cadet leadership positions are preparing cadets well for officer responsibilities and where program adjustments would be a wise investment. This dissertation will examine the responsibilities assigned to leaders in the positions showing strong associations with officer promotion to suggest which kinds of experiences likely contribute to leader development.

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[2] This dissertation uses participation in a cadet line position (e.g. squadron commander) to evaluate admission information because line position shows a significant association with promotion. This dissertation shows evidence that suggests selection for a line position is based on merit in the "Research Question 1" section of the "Results and Discussion" chapter. Anecdotally, meritorious past leadership performance and potential were described to me as selection factors while I attended the Academy.

RESEARCH QUESTIONS

Research questions for this dissertation involve the Academy application process, Academy leadership positions, and Air Force officer performance in order to illuminate the procedure for selecting cadet leaders and differences between types of cadet leadership positions. Answering these questions will yield policy recommendations targeting selection and training improvements.

- **Research Question 1:** Do cadets selected for Academy leadership positions have higher Academy military, academic, and athletic performance scores than cadets not selected for leadership positions prior to being selected as leaders?
- **Research Question 2:** Participation in which types of cadet leadership positions shows a statistically significant association with promotion to at least the rank of Lieutenant Colonel after controlling for relevant and available covariates such as Academy grade point average?
- **Research Question 3:** How does the effect on promotion of holding an Academy line leadership position differ depending on Academy performance, application scores, and demographic information?
- **Research Question 4:** How does the effect on promotion of holding an Academy leadership position differ by career field assignment at graduation?
- **Research Question 5:** Which Academy admissions and demographic variables show significant associations with participation in a cadet line leadership position?

In concert, addressing these five research questions will clarify which leadership positions likely prepare cadets well for officer responsibilities, which cadets are most likely to benefit from certain positions, and which applicants display valuable leadership potential. With this information it will be possible to make policy adjustments to improve how cadets are selected for admission to the Academy and for cadet leadership positions. It will also be possible to make adjustments to the leadership position responsibilities in order to better facilitate cadet leadership development.

2. Literature Review

Concept of Leadership

The concept of leadership has been described as "complex", "puzzling", and "elusive" (Kets de Vries and Engellau, 2010, p. 192; Cronin, 2001, p. 255; Owens, 2001, p. 265). Klenke (1993, p. 112) remarked that "There are probably few areas of inquiry and practical importance which have produced more divergent, inconsistent, overlapping definitions, theories, and educational models than leadership." Yukl (1989, p. 252) argued that leadership has been defined in many terms including individual traits, leader behavior, interaction patterns, role relationships, follower perceptions, influence over followers, influence on task goals, and influence on organizational culture. A sample of leadership definitions is listed below:

- Leadership is the process of influencing others to understand and agree about what needs to be done and how to do it, and the process of facilitating individual and collective efforts to accomplish shared objectives (Yukl, 2010, p. 8)
- Leadership is a process whereby an individual influences a group of individuals to achieve a common goal (Northhouse, 2010, p. 3)
- Leadership is directing, coordinating, supervising, and performing the many functions which the assigned tasks of the group or organization require (Fiedler, 1971, p. 110)
- Leadership is all about getting people to work together to make things happen that might not otherwise occur or to prevent things from happening that would ordinarily take place (Taylor, Rosenbach, and Rosenbach, 2009 p. 1)
- Leadership is accepting responsibility to create conditions that enable others to achieve shared purpose in the face of uncertainty (Ganz, 2010, p. 527)

- Leadership is accomplishment of group goals through behavior of others by application of the process of analysis, judgment and action (Madden, 1971, p. 2)
- Leadership is essentially an influence process whereby one gains trust and respect of subordinates and moves them toward goals without unduly relying on positional authority (Ulmer Jr., 2009, p. 101)
- Leadership is influencing others to follow (Lorsch, 2010, p. 414)
- Leadership is a type of work process rather than a formal position or the mere exercise of formal authority (Ibarra, Snook, Ramo, 2010, p. 663)

Yukl (1989, p. 252) noted that while definitions of leadership generally agree that leadership is an influence process, they differ in important respects such as who exerts influence, the purpose of influence attempts, and the manner in which influence is exerted. These differences in definition lead to further differences in how researchers choose to study leadership and interpret their results. A proliferation in terminology about leadership and perspectives on leadership has resulted in a greater necessity to clearly delineate the boundaries of the leadership concept being examined in this dissertation.

This dissertation uses a leadership concept that draws heavily on the U.S. Air Force concept of leadership and aligns with the common idea that leadership is a process involving people aimed at a goal. This dissertation views the concept of leadership as fundamentally about an interaction between people, which is consistent with the Air Force definitions of leadership listed below. A position of authority does not signify leadership by itself, despite common language describing “the leadership” of an organization as the collection of authority positions (Kotter, 1990, p. 3; Cronin, 2011, p. 255). The Air Force perspective on leadership contains both inspirational and managerial interpersonal elements directed at achieving an objective. The inspirational element involves influencing others to internalize

the values of the organization and develop a personal stake in the organization's success (AFDD 1-1, 2011, p. 55). The managerial element involves directing others to align their efforts with the organization's mission (AFDD 1-1, 2011, p. 36). The Air Force definition of leadership has remained largely consistent from 1985 to the present and highlights the inspirational and managerial elements of leadership:

> (1985) Leadership is the art of influencing and directing people to accomplish the mission (Carver, 1985, p. 2).
>
> (2006) Leadership is the art and science of influencing and directing people to accomplish the mission (AFDD 1-1, 2006, p. vi).
>
> (2011) Leadership is the art and science of motivating, influencing, and directing Airmen to understand and accomplish the Air Force mission in joint warfare (AFDD 1-1, 2011, p. 22).

The Army definition of leadership is similar to the Air Force definitions listed previously. Both definitions describe leadership as a process of interaction between people:

> (2007) The Army defines leadership as influencing people by providing purpose, direction, and motivation, while operating to accomplish the mission and improve the organization (Department of the Army, 2007, p. 1).

The Navy and Marine Corps choose to present their concepts of leadership with lists of principles and traits rather than defining leadership explicitly (AUSLS "Principles," 2012; AUSLS "Marine," 2012). Similarly the Coast Guard presents its concept of leadership with a set of leadership competencies (AUSLS "U.S. Coast Guard," 2004). The Navy, Marine Corps, and Coast Guard may choose to present their concept of leadership in this form because it is prescriptive and practical for aspiring leaders. In addition to presenting an explicit definition of leadership, the Air Force doctrine document on leadership presents core values and leader characteristics that resemble the Navy, Marine Corps, and Coast Guard lists of principles, traits, and competencies respectively. The Air Force presentation of its leadership concept

contains both an explicit explanation of what the Air Force considers leadership and prescriptive elements recommending the values and characteristics leaders should display.

A lengthy argument exists in the leadership literature concerning whether leaders are born or made. Tom Wolfe (1979, p. 17) coined the phrase "the right stuff" to capture a prevailing attitude in the pilot culture after World War II that a pilot "should have the ability to go up in a hurling piece of machinery and put his hide on the line and then have the moxie, the reflexes, the experience, the coolness, to pull it back at the last yawning moment – and then go up again the next day, and the next day, and every next day, even if the series should prove infinite." Wolfe (1979, p. 114) described how pilots at the time saw themselves as "natural-born stick-and-rudder men" born with these characteristics. McCall (1998, p. xi) and Cronin (2001, p. 255) illustrated how the idea that effective leaders are born with the right mix of critical characteristics is similarly alluring to many people due to its conceptual simplicity. Avolio (2010, p. 746) reported commonly encountering the opinion that leadership ability is more born than made while conducting leadership development workshops.

This dissertation rejects the idea that leaders must *only* be born with "the right stuff" and concurs with the Air Force's assertion that leadership ability stems from *both* innate capabilities and experience (AFDD 1-1, 2006, p. vi).[3] Recent empirical research supports the importance of both innate capabilities and experience. Arvey et al. (2006, pp. 1-12) employed a behavior genetics research design using identical and fraternal twins to estimate the heritability of leadership role occupancy. The authors concluded that 30% of the variance in holding a leadership role was attributable to genetics, while the remaining 70% of the variance was attributable to

[3] Innate capabilities here refers to those stable parts of an individual's disposition that are heritable or developed before puberty and vary little over adulthood such as personality, intelligence, creativity, and charisma (McCrae and Costa, 1994, pp. 173-75; Magnusson and Backteman, 1978, pp. 481-90; Adair-Toteff, 2005, pp. 189-204).

environmental factors. In studying a sample of business executives, Kotter (1990, p. 150) concluded "Of the characteristics [successful executives] shared, approximately one-third probably have roots in heredity or early life experiences…The rest of the shared characteristics are more obviously associated with experiences that come after puberty." Seeking to understand the rise of successful people, Gladwell (2008, p. 38) commented that "the closer psychologists look at the careers of the gifted, the smaller the role innate talent seems to play and the bigger the role preparation seems to play."

Arvey et al. and Kotter's findings above suggest the question of whether leaders are born or made is a false dichotomy. Heritable elements and life experiences both impact emergence and success as a leader. These studies confirming the importance of experience for emergence and success of leaders support the idea that leadership is developable. General Norton Schwartz, former Air Force Chief of Staff, also argued that leadership is developable (AFDD 1-1, 2011, foreword). Since effective leadership depends on both innate capabilities and experience, this dissertation attends to both leader selection and development.

In contrast to a popular view in academic literature that leadership is distinct from management, the definition of leadership proposed for this dissertation includes a management function (Kanter, 2010, p. 573; Kotter, 1990, p. 150; McLean and Weitzel, 1991, p. 78). In response to those advocating a conceptual divide between leadership and management, McDermott (1983) argued "the Air Force must have leaders who can manage and managers who can lead. The Air Force should not seek to separate these concepts or concentrate on one at the expense of the other." Poe (2001, p. 405) remarked it is a "pity" that the military community sometimes feels "embarrassed to equate 'leadership' with the routine, the matter of course, the customary." In a memorandum of instructions to members of the Lieutenant Colonel promotion board in 2011, the Secretary of the Air Force described how the Air Force "needs leaders who not only inspire, but can effectively manage the business of the Air Force" (Donley, 2011). By including language about the necessity of managing with language about inspiring,

these board instructions clarify that management is a part of the Air Force concept of leadership. As a result, functions such as managing a system of rewards and punishments for subordinates, though viewed by some in the academic community as distinct from leadership, will be included in the definition of leadership used for this dissertation (Bennis, 1989, pg. 17).

AIR FORCE ACADEMY DEVELOPMENT PROGRAM

Air Force Pamphlet 35-49 asserts that airmen can develop themselves as leaders by: thinking about leadership, studying leadership, observing leaders in action, and practicing leadership (Carver, 1985, p. 8). The Air Force Academy leader training program assists cadets with each of these approaches to some degree by providing academic leadership courses, team exercises, and cadet leadership positions (Lindsay, Day, and Halpin, 2011, p. 545). Jackson, Lindsay, and Coyne (2010, p. 38) detailed how "the entire USAFA experience is designed to facilitate growth in both leadership and character. This is done through an academic and experiential process that progressively increases in responsibility and scope as a cadet progresses through USAFA."

The idea that experiential leadership training is more important than classroom training is widely held (Hernez-Broome and Hughes, 2004, p. 25; Cronin, 2001, p. 256). Ibarra, Snook, and Ramo (2010, p. 657) claimed managers develop management skills primarily from experience managing their employees. General Omar Bradley (2001, p. 422) argued the best way to develop leadership is to hold a job with leadership responsibilities. Fiedler (1971, p. 111) described the Academy's leadership development program as being "designed to remake the whole man…[with the] expectation that leadership experience contributes to leadership performance." Jackson, Lindsay, and Coyne (2010, p. 42) claimed "There is no doubt that the opportunity to perform in a leadership position [at the Academy] contributes significantly to the development of leadership skills." This dissertation focuses on empirically testing the connection between leader development and the experience of practicing leadership in cadet leadership positions. It

is important to note the Academy leader training program includes more elements than just cadet leadership positions, but those other elements will not be evaluated in this dissertation.

Many leadership positions exist at the Academy. This dissertation examines the nine leadership position types listed in Table 2.1: line, aviation, basic cadet training cadre, athletic team captain, staff, air educational and training command cadre, combat survival training cadre, summer seminar cadre, and summer composite group. Descriptions of the responsibilities associated with each position are also included in Table 2.1. While the collection of leadership positions in Table 2.1 is not a comprehensive list of all positions available at the Academy, I feel the most prominent positions in terms of number of participants are included, and the positions included possess breadth across the military, aviation, and athletic elements of the Academy.

The line position type includes cadet command positions at the wing, group, and squadron level as well as the squadron director of operations position. These positions are responsible for daily execution of cadet wing programs and policies at their respective levels in the cadet wing hierarchy. Each of these positions involves mentorship from commanding officers (i.e. Commandant of Cadets, Group Air Officer Commanding, Squadron Air Officer Commanding).

The aviation position type includes soaring, parachute, and powered flight instructor positions. All of these positions involve instructing other cadets in how to perform aviation tasks.

The basic cadet training cadre position involves acting as an instructor for basic cadets during their first six weeks at the Academy. Cadre instruct basic cadets on various topics such as the military rank system, how to march in formation, and how to wear a military uniform.

Athletic team captains are responsible for the discipline of their team and any tasks assigned by their team coach.

The staff position type is composed of nine positions spanning the wing, group, and squadron levels. The duties for these positions vary, but they are similar in that they all act as advisors to the cadet line leaders to whom they report.

Cadets holding an Air Education and Training Command summer cadre position travel to Lackland Air Force Base in San Antonio, Texas during the summer and serve as assistants to training instructors during a session of enlisted basic training.

The combat survival training cadre position involves serving as an instructor during the summer survival training course conducted in Jack's Valley on the Academy campus.

The summer seminar cadre position involves counseling and escorting high school seniors during two one-week sessions designed to familiarize prospective cadets with the Academy experience.

The summer composite group position involves providing administrative and logistic support for cadets using cadet facilities during the summer.

Each of the positions examined in this dissertation requires the participant to interact with a group of subordinates. Positions that do not require this interaction, such as summer academic research, are not included. Note that some position types represent an aggregation of several positions, while other types contain only one position. Also note the aviation position type was created by the author for this work based on similarities between the soaring instructor, parachute instructor, and powered flight instructor positions, while the line and staff position type groupings are official Academy categorizations.

This dissertation does not analyze leadership position types held by freshmen and sophomore cadets. Freshman and sophomore leadership positions are more informal than the junior and senior positions and involve only a few responsibilities.

Holding a leadership position of one type does not exclude a cadet from holding a position of another type. For example, a cadet holding a basic cadet training cadre position may also hold an athletic team captain position. Data on several leadership positions were unavailable for the years in the sample such as the deputy group commander under the line position type and the academic officer position in the staff position type.

Table 2.1
Leadership Position Descriptions

Position Type	Position	Description[a]
Line Leader		
	Wing Commander	**Duties:** Reports to the Commandant of Cadets. Implements and administers Commandant of Cadets (USAFA/CW) command of the Cadet Wing (AFCW). Responsible to USAFA/CW for all duty functions performed by cadets. Ensure Air Force, USAFA, USAFA/CW and AFCW policies and instructions are enforced. Responsible for implementation and execution of the Stan/Eval Program. Supervise all AFCW activities by delegating authority to staff and subordinate commanders. Enforce proper discipline and conduct in the AFCW. Advises the USAFA/CW on the state of the Cadet Wing.
	Vice Wing Commander	**Duties:** Reports to the AFCW Wing Commander. Executes the Wing Commander's functions in his/her absence. Serves as AFCW Director of Staff and principle advisor to the Wing Commander. Serves as the AFCW Inspector General (IG) and complaints monitor. Serves as the representative on the Honor Review Committee Executive Panel (HRCEP). Responsible to the SUAFA/CW for the functions of the AFCW.
	Group Commander	**Duties:** Reports to and is responsible to the AFCW Commander. Implements and administers Group AOC's policies to the group. Responsible to the Group ACO and Wing Commander for all duty functions exercised by cadets in the group. Supervises all cadet group activities by delegating authority to cadet group staff and subordinate Squadron Commanders. Enforces proper discipline and conduct. Advises the Group AOC and Wing Commander of the state of the Group.
	Squadron Commander	**Duties:** Reports to and is responsible to Group Commander and Squadron AOC. Responsible for the health, morale, and welfare of the squadron, and all operations of the squadron. Supervises all squadron activities through delegation of authority to squadron staff. Supervises Cadet Squadron staff and Flight Commanders.
	Squadron Director of Operations	**Duties:** Reports to and is responsible to the squadron commander. Assume responsibility for command of the squadron in the absence of the squadron commander. Coordinates the squadron's operational functions with the flight commanders. Responsible for the day-to-day operations of the squadron within line/staff framework.
Aviation Leader[b]		
	Soaring Instructor	**Duties:** Serve as instructors in Airmanship 251 and Airmanship 461 courses.
	Parachute Instructor	**Duties:** Serve as instructors and jumpmasters for the Airmanship 490 and upgrade courses. This responsibility includes ground training, equipment fitting, preflight inspection, aircraft loading, all prejump action to include emergencies, and safe and orderly egress from the aircraft.[c]
	Powered Flight Instructor	**Duties:** Cadets instruct in Aviation 100, 280, 460, and 470 classroom, trainer and flying programs.
Basic Cadet Training Cadre		**Duties:** Serve as instructors in the cadet chain of command during Basic Cadet Training.

Table 2.1-Continued

Position Type	Position	Description[a]
Athletic Team Captain		**Duties:** Responsible to their specific team coach and any assigned duties relating to the team. Responsible for the daily accountability, appearance, performance, conduct and training of all team members during scheduled team practices, meetings, competitions, trips, and other gatherings such as social events and ramps.
Staff Leader		
	Wing Executive Officer	**Duties:** Reports to and is responsible to the Wing Commander. Administrative assistant to the Wing Commander. Assists the Vice Wing Commander in the management of wing staff taskings.
	Wing Character Officer	**Duties:** Reports to and is responsible to the AFCW Commander. Provides AFCW with more accessible resources to aid in the development of USAFA cadets. Works in concert with the Center for Character Development, to ensure all character specific seminars and conferences maximally benefit each cadet. Provides opportunities for cadets to get involved in character symposiums and other leadership oriented activities.
	Wing Director of Safety	**Duties:** Reports to and is responsible to Cadet Wing Commander for ensuring the safety of the cadet wing, and that the cadet wing complies with safety policies, instructions/directives. Coordinates periodic safety inspections and emergency response exercises.
	Group Executive Officer	**Duties:** Reports to and is responsible to the Group Commander. Serves as administrative assistant to the Group Commander. Screens all correspondence sent to and from the Group Commander for accuracy and timeliness.
	Group Honor Chairman	**Duties:** Responsible to the Wing Honor Chairperson for executing responsibilities associated with honor system administration. The Group Honor Chairperson ensures the activities of the Squadron Honor Representatives are standardized and conform to guidelines.
	Squadron Executive Officer	**Duties:** Reports to and is responsible to the Squadron Commander. Serves as administrative assistant to the squadron commander. Screens all correspondence sent to and from the squadron commander for accuracy and timeliness.
	Squadron Chief of Athletics	**Duties:** Report to and is responsible to the Squadron Director of Operations. Monitors and coordinates athletic matters between the squadron and the group. Works with group to administer athletic policies and represents cadet interests to the Athletic Department.
	Squadron Chief of Standardization and Evaluation	**Duties:** Reports to and is responsible to the squadron commander. Directs the Stan/Eval Program, under the guidance of the Squadron Commander, Group and Wing Directors of Stan/Eval. Responsible for the squadrons inspection programs, evaluation of training, and trend analysis. Conducts both formal and informal inspections, within the squadron and at the direction of Group and Wing Staff.
	Squadron Chief of Training	**Duties:** Reports to and is responsible to the Squadron Director of Operations. Monitors cadet-conducted training in the squadron. Concentrates on weekly training activities for all classes. Aids in the development of programs with Group Training Officer to ensure Cadet Wing training is relevant and effective.

Table 2.1-Continued

Position Type	Position	Description[a]
Air Education and Training Command Summer Cadre		**Duties:** Serve as assistants to squadron commanders and as basic airman training instructors and counselors with a Basic Military Training Squadron at Lackland AFB, Texas.
Combat Survival Training Cadre		**Duties:** Serve as instructors in the cadet chain of command for the CST training program.
Summer Seminar Cadre		**Duties:** Cadets serve as counselors and escorts for approximately 450 high school seniors from all 50 states. During the two one-week sessions, the high school students are housed in Vandenberg Hall, attend scientific workshops, tour the Academy and surrounding areas, participate in recreational sports, and attend various evening programs.
Summer Composite Group Leader		**Duties:** Maintain command, control, and accountability and provide billeting for all cadets taking summer academic courses and transient cadets using cadet area facilities.

[a] Position descriptions are taken verbatim from Air Force Cadet Wing Instruction 38-101 "Command Duties and Responsibilities"
[b] This position type category was created by the author.
[c] This description comes from Gurney and Sheehan, 1978, p. 87.

Leadership as a Component of Officership

Officer promotion decisions in the Air Force consider leadership ability and other elements of officer performance (Donley, 2011). This dissertation uses promotion data as an outcome measure in examining the effectiveness of nine types of Academy leadership positions. McCoy (1996, p. 5) suggested the concept of officership eludes definition and should instead be viewed as a recipe with many ingredients such as values, courage, accountability, loyalty, responsibility, discipline, leadership, character, trust, and authority. McCoy (1996, p. 5) argued that each officer must individualize his or her recipe to give it a "distinct flavor."

Air Force promotion instructions define officership in more concrete terms in order to facilitate the evaluation process for promotion, but even these instructions show the conceptual breadth of officership. Job performance, professional qualities, leadership, experience, job responsibility, advanced education, and achievements are all listed as elements of officership relevant to consideration for promotion (Donley, 2011). Each of these officership components is related to leadership to the extent that it impacts a leader's ability to inspire or manage people.

Fallesen, Keller-Glaze, and Churnow (2011, p. 466) highlighted the difficulty in separating leadership from job performance. Some parts of officership are not primarily concerned with leadership (e.g. preparing an intelligence brief), but all parts of officership are in some way connected to leadership, even if only through establishing the reputation of the officer. Accordingly, leadership should not be viewed as an exclusive subcomponent of officership that can be separated from the other officership components.

While certain officer assignments involve more leadership responsibility than others, leadership is viewed by the Academy as the fundamental core of officership: the Air Force Academy's Leadership Development Manual directs cadets that "An officer is a leader first and foremost. Everything else you do as a specialist in the Air Force is subordinate to your role as a leader" (Rosebush, 1992, p. 1-3).

Since leadership fills the core of officership and becomes an increasingly larger portion of an officer's responsibilities as his or her number of subordinates increases with rank, promotion data will be used to construct the outcome measure for the analysis in this study (Department of Defense, 2012; Vickers, 1996, p. 3).[4]

TYPES OF LEADERSHIP PERSPECTIVES

After conducting an extensive review of leadership literature, Jago (1982) distilled the many definitions of leadership into four perspectives that imply different practical approaches for organizations. Because each of the perspective types in this framework imply different approaches for an organization to reach the goal of having effective leaders, this framework is particularly useful for organizing leadership literature as it relates to policy options for the Air Force Academy.

Table 2.2
Jago's (1982) Typology of Leadership Perspectives

		Theoretical Approach	
		Universal	Contingent
Focal Leadership Construct	Leader Traits	Type I	Type III
	Leader Behaviors	Type II	Type IV

[4] As background to the main analysis presented in Chapter 4, I examine average values of Academy performance variables for the group of officers leaving the Air Force and the group of officers remaining in the Air Force at key retention points. I perform this analysis to counter the claim that more skilled officers exit the military earlier than less skilled officers. The quality of officers remaining in the service consistently exceeds the quality of officers exiting the service. This fact increases my confidence that promotion is a desirable outcome measure. If promotion was not a signal of quality, it would be inappropriate to use it as an outcome measure in this dissertation. Details on this background analysis are presented in Appendix A.

According to the typology shown in the table above, Jago (1982, p. 316) classified leadership perspectives as having a *universal* or *contingent* theoretical approach. The universal approach argues that what constitutes effective leadership does not vary based on situational context. The contingent approach argues that what constitutes effective leadership does vary for different situational contexts. Jago (1982, p. 316) also classified leadership perspectives as having either a *trait* or *behavior* focal construct. The trait construct advocates the importance of a person's innate characteristics in distinguishing effective from non-effective leaders. In contrast, the behavior construct advocates the importance of learned behaviors for distinguishing effective from non-effective leaders. Classifying a leadership perspective on these two dimensions results in four different perspective types.

Implications for Organizations

Each perspective in the typology above suggests a different action from an organization aiming to develop leaders. The Type I perspective (trait construct & universal approach) implies selecting leaders based on exhibition of required traits thought to be important for all leadership responsibilities (Jago, 1982, p. 317). For example, if an extraverted personality is thought to be important for all leadership responsibilities, an organization may give members a personality test and use the extraversion measure as a criterion for leader selection. The Type II perspective (behavior construct & universal approach) implies training leaders to adopt one behavioral style for use in all situations (Jago, 1982, p. 320). For example, if being very authoritative when giving direction to subordinates is thought to be an appropriate leader behavior style in all situations, an organization may give its members a training course on how to adopt this authoritative behavior style in interactions with subordinates.

The Type III perspective (trait construct & contingent approach) can imply a matching responsibility for administrators or individual leaders (Jago, 1982, p. 323). Administrators can try to match the trait profile of the organization's leaders to the situation where each

individual is expected to be most effective. For example, if being extraverted is thought to be important for a leader in the marketing department, while being introverted is thought to be important for a leader in the research department, an organization may give members a personality test and place leaders in the position that better fits their personality. This matching responsibility can also lie with the individual leader instead of administrators. An organization's model may demand the leader discover a niche where his or her traits allow for effectiveness and pursue a leadership role in that area.

The Type IV perspective (behavior construct & contingent approach) implies organizations should train individuals with a variety of effective behavioral styles to be exercised according to the characteristics of the situation confronted by the leader (Jago, 1982, p. 326). For example, if an authoritative behavioral style is thought to be effective for new subordinates in the organization while a more nurturing behavioral style is thought to be effective for more seasoned subordinates, an organization may train leaders on how to employ both of these styles depending on the subordinate.

Overview of Each Perspective Type

Research focus has shifted between these types over time, but arguments about the merits of the different approaches continue today.

Leadership research for the first half of the 20th century primarily concentrated on the Type I perspective (Jago, 1982, p. 317). Researchers aimed to validate "great man" theories by demonstrating predictive relationships between a set of enduring human characteristics and positive leadership outcomes (Northhouse, 2010, p. 15). Empirical support for the Type I perspective is very limited (Jago, 1982, p. 318). The discovery of exceptions to general rules proposed previously has led researchers to largely abandon testing Type I hypotheses (Jago, 1982, p. 318). Recently, research on the Type I perspective has resurfaced due to interest in visionary and charismatic leadership (Northhouse, 2010, p. 16).

Type II research pursues identification of leader behavior patterns effective in all situations. Evidence indicating the

importance of situational contingencies when examining these general behavior styles has directed research elsewhere and has caused many to view the notion that "leadership depends on the situation" as an "obvious truism" (Jago, 1982, p. 322). Despite this intellectual trend, training programs grounded in this perspective, such as Blake and Mouton's (1966) Managerial Grid, still remain.

Examining which leader traits are important in different situational contexts is the primary focus of Type III research (Jago, 1982, p. 322). Debate on the legitimacy of the Type III perspective has largely surrounded the measures and methodology used. Research of this type is still commonly studied empirically (Jago, 1982, p. 323).

The Type III perspective focuses on leader traits like the Type I perspective and examines which leader traits are important in certain situations. Similarly, the Type IV perspective focuses on leader behaviors like the Type II perspective and examines which leader behaviors are important in different situations. The Type IV perspective has garnered close attention from those concerned with the content of leadership development programs (Blanchard, Zigarmi, and Nelson, 1993, pp. 1-21). An iterative cycle of training program creation and evaluation continues to build the empirical foundation for this perspective.

Classic Research Examples for Each Perspective Type

This section details examples of prominent research conducted on each of the perspective types described above.

Type I. Following reviews conducted by Stogdill (1948) and Mann (1959) highlighting the lack of empirical support for a set of universal leader traits predicting leader emergence, Lord, DeVader, and Alliger (1986, pp. 402-410) sought to demonstrate the existence of a universal relation between personality traits and leadership perceptions while explaining how methodological factors could have contributed to a premature rejection of the Type I perspective. Judge et al. (2002, pp. 765-80) also contended the abandonment of research aimed at identifying universally important leadership traits was unwarranted by showing meta-analytic support for the Type I perspective

when organizing traits according to the five-factor personality model. They found extraversion, openness to experience, and conscientiousness to consistently correlate with leadership criteria (Judge et al., 2002, pp. 765).

Charisma, like personality, is another individual trait examined in relation to leadership. Max Weber's original conceptualization of the charismatic leader described charisma as a power derived from unique personal characteristics (Northhouse, 2020, p. 173). In a meta-analytic review of charisma, as measured by the Multifactor Leadership Questionnaire, Lowe, Kroeck, and Sivasubramaniam (1996, p. 414) found charisma to be positively related to leader effectiveness "regardless of type of organization, level of the leader, or in how effectiveness was measured." This finding relating charisma to leader effectiveness in many situations supports the Type I perspective.

Type II. Transformational leadership as detailed by Bass is characterized by four behaviors advocated for any leadership challenge: individualized consideration, intellectual stimulation, idealized influence, and inspirational motivation (Bass, 1990, pp. 19-31; Bass, 1999, pp. 9-32).[5] Because the theory of transformational leadership advocates a universally applicable behavioral style, it falls within the Type II perspective. This Type II perspective has generated intense interest from both practitioners and researchers, partially due to an accompanying measurement instrument, the Multifactor Leadership Questionnaire, which facilitates quantification and testing. Yukl (1999, p. 292) questioned the universal applicability of transformational leadership behaviors and recommended examining the effectiveness of these behaviors in different situations.

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[5] Bass defines each of these behavioral approaches as follows: "idealized influence – provides vision and sense of mission, instills pride, gains respect and trust; inspiration – communicates high expectations, uses symbols to focus efforts, expresses important purposes in simple ways; intellectual stimulation – promotes intelligence, rationality, and careful problem solving; individualized consideration – gives personal attention, treats each employee individually, coaches, advises." Bass, 1990, p. 22.

Type III. Fred Fiedler's contingency model is the most prominent line of research on the Type III perspective (Jago, 1982, p. 322). Fiedler's (1971, p. 128) contingency theory categorizes leaders into two types: task-oriented or relationship-oriented. The influence of each of these leader types on organizational performance is moderated by a situational favorableness dimension with three sub-dimensions: leader-member relations, task structure, and position power (Fiedler, 1971, p. 129). Fiedler's contingency theory predicts task-oriented leaders will perform better in very favorable and unfavorable situations, while relationship-oriented leaders perform better in intermediately favorable situations (Fiedler, 1971, p. 128). Empirical evidence from a study of section chiefs of a field artillery group supports this prediction (Fiedler, 1972, p. 462).

Type IV. Fiedler's theory classifies leaders into two types based on personality style, but others argue a focus on leader behavior style is more appropriate. The theory of situational leadership, championed by Paul Hersey and Ken Blanchard, argues for different behavioral styles to be applied according to characteristics of the leadership situation (Blanchard, Zigarmi, and Nelson, 1993, pp. 1-21). Hersey and Blanchard formed the concept of situational leadership by extending the simplistic idea that children require different parenting styles at different development stages to organizations (Blanchard, Zigarmi, and Nelson, 1993, pp. 1-21). Situational leadership is defined by four manager leadership styles and four employee development levels. Each of the four manager leadership styles (delegating, supporting, coaching, and directing) is recommended for a corresponding employee development level. Vecchio et al. (2006) tested the utility of situational leadership theory in a military academy context. They found a lack of evidence supporting an interaction between leader style and follower attributes in predicting follower performance (Vecchio et al., 2006, p. 407). The authors suggested that situational leadership may need to include factors beyond follower readiness/maturity such as leader organizational level, pressure for consistency of leader actions, and presence of a crisis event (Vecchio et al., 2006, p. 421).

Where the Air Force Academy Curriculum Fits Within Jago's Typology

As part of the academic curriculum at the Academy, cadets take a class titled "Foundations of Leadership Development" taught by the Behavioral Sciences and Leadership Division (Jackson, Lindsay, and Coyne, 2010, p. 39). The course is designed to present cadets with scholarly perspectives on leadership that they can apply to leadership experiences at the Academy (Granger and Reiley, 2007). Included in the curriculum for this class are leadership perspectives representing each of the types described previously. Personality traits, transformational leadership, Fiedler's contingency model, and situational leadership are all covered in the course (Granger and Reiley, 2007).

The Air Force Academy program does not adhere exclusively to one of the leadership perspectives presented above. The Type I perspective is relevant because the Academy deems certain traits, such as trustworthiness, universally important (Rosebush, 1992, p. 2.5). The Type II perspective is relevant because the Academy wants cadets to demonstrate certain behaviors, such as treating subordinates with respect, in all leadership situations (Rosebush, 1992, p. 3.2). While I attended the Academy, I frequently observed Academy administrators directing cadets to match their innate strengths and talents to leadership responsibilities. This type of direction reflects the Type III perspective. I also observed administrators advising cadets to first assess characteristics of a leadership situation as a way of informing their choice of leadership behavior. This type of direction indicates the Type IV perspective is also relevant at the Academy. Including ideas from each of the leadership perspectives presented above in the Academy program is supported by Stogdill's (1974, p. 72) contention that "different leadership skills and traits are required in different situations…Yet certain general qualities – such as courage, fortitude, and conviction" characterize leaders in general.

Traits as defined in the leadership literature vary little after adolescence. Consequently, the role of training in the Type I perspective is minimal. Selecting applicants with the traits considered important by the Academy and reinforcing those traits after the individual enters the Academy are the primary connections between the

Type I perspective and the Academy program. In contrast, training plays an important role in the other three perspectives.

Academy leadership positions provide experience and concrete situational context which are both particularly valuable in relation to training. The interactions resulting from leadership position responsibilities give cadet leaders an opportunity to practice treating subordinates with respect, which is a behavior the Academy wants cadets to master and use in all situations. These interactions also give cadet leaders an opportunity to learn which kinds of leadership responsibilities match well with their innate strengths. For example, a cadet leader may realize her personality makes her effective in positions requiring a large amount of face-to-face interaction with subordinates. Matching leadership style with the development level of followers is a prescription of the situational leadership theory taught to cadets as part of the "Foundations of Leadership Development" course (Blanchard, Zigarmi, and Nelson, 1993, p. 26). Interactions resulting from leadership position responsibilities provide cadet leaders with an opportunity to practice analyzing leadership situations and applying an appropriate behavioral approach tailored to the specifics of the situation. For example, a cadet leader can practice applying a directing leadership style to new fourth class cadets who have little experience in the organization.

MILITARY LEADERSHIP LITERATURE

This section details leadership research conducted in a military context.

Atwater and Yammarino (1993, pp. 645-68) investigated the relationship between trait variables (e.g. intelligence, warmth, conformity) and subordinate and superior ratings of leadership behavior. The sample for the study was made up of U.S. Military Academy cadets holding leadership positions. The authors found traits such as intelligence and conformity to be significant predictors of transformational and transactional leadership behaviors (Atwater and Yammarino, 1993, p. 660). A possible explanation of this finding is that leader traits may affect the adoption and enactment of leader

behaviors. One possibility is that higher intelligence enables a leader to quickly grasp the principles of transformational and transactional leadership taught in a seminar and apply them to real situations.

Atwater and Yammarino's research showing relationships between leader traits and behaviors indicates that studying leader effectiveness requires considering both traits and behaviors. This dissertation examines the relationship to officer promotion of both traits, such as intelligence, age, and race, and the opportunity to practice leader behaviors in a leadership position. This dissertation also examines interactions between traits and participation in a leadership position to identify which traits moderate the relationship between cadet leadership positions and promotion. For example, this dissertation tests if the effect of holding a leadership position on promotion increases as scores on a cognitive ability test increase.

Atwater and Yammarino (1993, p. 663) also found evidence supporting the importance of athletic experience for developing leadership skills in a military academy context. The analytic models proposed in this dissertation include information about individuals' past athletic experience and physical fitness in order to understand how these factors relate to the effectiveness of leadership training and officer promotion.

Seeking to identify determinants of military career success for Air Force Academy graduates, Rodriguez (2009, pp. 65-85) hypothesized that cadets who perform best in high school on measures such as standardized test scores and grade point average and at the Academy on measures such as number of probations will be less likely to achieve military career success due to better career opportunities outside the Air Force. Rodriguez defined career success as at least twenty years of service and achievement of the rank of at least Lieutenant Colonel. He then predicted this success measure with Academy admission variables, cadet performance measures, and rated career field indicators. Rodriguez found the following variables as significant predictors of career success in the directions indicated in parenthesis: gender (1=male, 0=female) (+), black (-), Hispanic (-), prior academic record (-), adjusted academic composite (+), candidate fitness test (-), Air

Force Academy prep school (-), grade point average (+), military performance average (+), academic probation (+), academic probation plus other probations (+), pilot (+), navigator (+), air battle manager (+), flight surgeon (+). The directions of the relationships with career success for some of the variables above are puzzling. For example, being on probation at the Academy has a positive association with career success, while scoring well on the admission fitness test has a negative association with career success. These puzzling results may be the result of using an outcome measure that combines officer retention behavior with promotion. This dissertation will only use promotion data to construct an outcome measure because adding retention information can complicate interpretation of the findings since promotion and retention are subject to different influences.

Pursuing improvement to the admission process at the Air Force Academy, Webb (2006) studied admissions variables as predictors of graduation from the Academy. Webb suggested adjustment to the admission leadership composite, which is created by the Academy admissions department using information about high school leadership activity, due to an empirical finding showing the leadership composite's limited value predicting graduation. For example, Webb (2006, p. 36) argued for reducing the weight of variables in the leadership composite without a significant relationship to graduation, such as years playing a high school varsity sport. This dissertation models the association between admission variables related to leadership and achieving a leadership position at the Academy. This dissertation provides additional information the Academy admissions department can use to potentially improve the leadership composite.

Micheli (1998) pursued answers to questions closely resembling those proposed in this dissertation (as detailed in the "Research Questions" section of the Introduction chapter) in a study of midshipmen leadership positions at the U.S. Naval Academy. The Naval Academy and Air Force Academy have similar legal requirements shaping

establishment and mission.[6] For both institutions, the U.S. code dictates the same authorized number of students, administrative leadership positions, nomination process for admission, and requirement that graduates accept an appointment as a commissioned officer. Consequently Micheli's work on the Naval Academy offers a natural point of comparison for this dissertation. Micheli found that individuals selected as Naval Academy leaders were better performers on average than those not selected when looking at both pre-Academy and Academy performance measures, such as SAT scores and military performance grades. Micheli (1998, p. 74) also tested the association between a variable indicating participation in a leadership position at the Naval Academy and an outcome variable indicating promotion to at least the rank of Commander (O-5) while controlling for an array of other covariates, such as an indicator for coming from a family where a parent was in the military. Micheli (1998, p. 74) found that holding a leadership position at the Naval Academy was significantly associated in a positive direction with promotion to O-5. This dissertation studying Air Force Academy leaders extends Micheli's research by dividing leadership positions into types based on differences in responsibilities. Analyzing how the effect of participating in a leadership position varies with Academy performance scores, application scores, demographic information, and career field group is another extension of Micheli's work implemented in this dissertation.

Zaccaro et al. (2009, p. 44) studied developmental work experiences of senior Army officers over their careers to understand if challenging experiences are associated with greater leader adaptability. The authors highlighted four individual attributes that might affect the developmental impact of challenging experiences: cognitive complexity, metacognitive skills, tolerance for ambiguity, and openness to experience (Zaccaro et al., 2009, p. 44). The authors found an association between challenging experiences and leader adaptability that is moderated by the four individual attributes listed

[6] See subtitles C and D of Title 10 of the U.S. Code.

above (Zaccaro et al., 2009, p. 45). This dissertation examines if participating in a cadet leadership position is associated with officer promotion. If cadets view leadership position participation as a challenging experience that forces them to constantly adapt to solve problems, the idea that a challenging experience improves leader adaptability could explain a significant finding between holding a cadet leadership position and promotion in this dissertation.

This dissertation also examines the influence of many individual attributes such as performance at the Academy, race, and gender on the association between participation in a cadet leadership position and officer promotion. Identifying the influence of individual characteristics on the associations between training and performance is an important step to uncovering the effective elements of training programs. For example, if a large positive association between participating in training and performance exists for people with poor social skills but not for people with excellent social skills, this information suggests the training might act to improve the social skills of the lower group. A hypothesis like this can then be tested explicitly in future work.

OTHER RELEVANT LITERATURE

Liu et al. (2003, p. 143) proposed a framework advocating certain leadership styles for particular employment settings. The authors considered four categories of employment arrangements: contracting, acquisition or job-based, alliance/partnership, and internal development or knowledge-based. The authors argued for matching directive, transactional, transformational, and empowering leadership styles to these employment arrangements respectively (Liu et al., 2003, p. 135). The authors also surmised that "It may be the case that effective leaders are able to essentially turn on or off different leadership styles depending on the circumstances" (Liu et al, 2003, p. 145).

This dissertation examines the relationship between cadet leadership positions and officer promotion for rated and non-rated career field groups in the Air Force to uncover whether cadet

leadership positions develop leadership skills that are beneficial for either career group, neither career group, or one of the two career groups. For example, finding that holding a cadet aviation position is related to promotion for cadets entering rated career fields but not for cadets entering non-rated career fields indicates the aviation position teaches skills primarily applicable to the rated career field group. If a cadet leadership position is related to promotion in both career field groups, this indicates the position experience teaches cadets leadership skills that are broadly applicable to both rated and non-rated career fields.

In the course of interviewing management educators, Doh (2003, p. 63) uncovered a consistent refrain that individuals who are motivated to improve their leadership skills and hold leadership positions are the most developable through training. Doh also reported interviewees emphasize past leadership experience, cognitive ability, and emotional intelligence as important factors influencing training effectiveness. This dissertation empirically explores how training effectiveness varies with individual-level factors such as cognitive ability, past leadership experience, gender, and race.

Title 10 of the U.S. Code requires Academy applicants to receive a nomination to attend the Academy. Because a large proportion of the nominations available are controlled by congresspersons, the geographic representation of Academy entrants resembles the geographic distribution of the U.S. population. Cohen et al. (1996, p. 945) found experimental evidence for differences in how people behave toward others according to region. The experiments focused on how individuals responded to others after experiencing a verbal insult. Though Cohen's study is not explicitly related to leadership, I assess that interacting with others in the midst of frustration is a part of leadership. If individuals interact differently with others when frustrated according to the region where they grew up, this effect could confound relationships in my analysis. Therefore, this dissertation includes a variable for the U.S. census region where a cadet attended high school as a control variable to account for possible differences in leadership style related to region.

3. Methodology

Sources of Data

The Institutional Research Division of the Academy's Plans and Programs Directorate provided data on cadets entering the Academy in the classes of 1980 through 2011. The data provided included raw admission elements and the composite scores calculated from those elements by the admissions department for use in selection decisions. A variable indicating whether or not an applicant held a student government position in high school is an example of a raw element. The leadership composite score, which includes a combination of many raw elements like the student government position variable, is an example of a composite score. Leadership position participation indicators, cadet performance measures, demographic information, and whether or not each cadet was commissioned as an officer were also provided. Limited career field and promotion data were provided by the Air Force Personnel Center.

Leadership Positions

The data provided by the Academy includes information about twenty two cadet leadership positions. I used this information to create twenty two dichotomous variables representing whether an individual did or did not participation in that leadership position while at the Academy. I then classified these twenty two leadership positions into nine types based on classifications used by the Academy and my own assessments of similarity.

Some leadership position participation indicators were missing in certain years, so I reduced the sample size for some of the analytic models to be able to include certain positions in the analysis. I divided the sample into four ranges of class years: 1983-95, 1985-95, 1983-88, and 1989-1991. Data for some positions are available for all of these class year ranges, while data for other positions are only available for one of the ranges. Each of the tables with model results

in the next chapter explicitly lists the class years used to produce the results.

OUTCOME VARIABLE

The use of an advancement measure such as promotion as a criterion necessitates that opportunities for advancement be generally equal for all members of the sample (Vickers, 1996, p. 15). Cadets with a first primary AFSC in non-line competitive categories such as Medical Corps, Nurse Corps, Judge Advocate General's Corps, Medical Service Corps, Biomedical Sciences Corps, and the Chaplain Corps are excluded from the sample since the promotion schedules for these competitive categories differ from line officers.[7]

An indicator for whether an individual was promoted to at least the rank of Lieutenant Colonel is used as the promotion outcome variable in this dissertation. The officer data available for this dissertation includes years 1980 through 2010. The class of cadets graduating in 1995 is the most recent cohort to pass the in-the-zone promotion phase to Lieutenant Colonel as of 2010. Since the classes of cadets graduating in 1996 and later had not had a full opportunity to be promoted to Lieutenant Colonel by 2010, the sample is restricted to class years 1995 and earlier when promotion is used as the outcome.

COVARIATES

This dissertation uses information listed on a cadet's application to the Academy, demographic information, and performance scores while attending the Academy at various points throughout the analysis. I collectively refer to these data as "covariates." Application information includes variables like standardized test scores, high school academic scores, and extracurricular activity scores. Age, race, gender, and region of high school attendance are examples of demographic information used. Grade point average and military performance average are examples of performance scores collected while

[7] Based on personal communication with a former Director of Operations for the Air Force Personnel Center.

attending the Academy that are used. I describe the covariates in greater detail where they are first introduced in the analysis sections.

METHODS

Analysis for this dissertation is divided into five sections according to the five research questions addressed. In this chapter, I generically describe the methods used in the five analysis sections of the next chapter. More details about the specific implementation of these methods are included in the analysis sections.

In the first section of analysis, I examine Academy performance differences between cadets holding leadership positions and cadets not holding positions. Average academic, military, and athletic performance scores are calculated for the group of cadets holding each type of leadership position and the corresponding group of cadets not holding that type of leadership position as a way of understanding the quality of cadets participating in each leadership position type.

Atwater and Yammarino (1993, p. 646) recommended multivariate regression as an appropriate method to "look at how a composite of traits or personal attributes predict leadership." In the second section of analysis, multivariate logistic regression and propensity weighted logistic regression methods are employed to test hypotheses about the relationship between participation in cadet leadership positions and promotion. The coefficients on the cadet leadership position participation indicators from these models inform a discussion about the relative effectiveness of different cadet leadership positions at preparing cadets for officer responsibilities. Power analysis is presented to accompany the model coefficients to clarify the detectable effect sizes for the leadership position types included in the models.

In the third section of analysis, I continue to employ logistic regression. I use a strategy combining subgroup division and interaction terms to understand how the effect of holding cadet leadership positions on promotion probability differs according to individual characteristics of interest such as race, cognitive ability,

and past military performance. The subgroup division technique is particularly useful for comparing individuals who are similar on a characteristic of interest but who differ on whether they held a cadet leadership position or not. For example, the subgroup division technique allows me to assess the effect of holding a cadet leadership position on the probability of promotion for males specifically. The subgroup division technique is simply performing a regression on a sample of the sample. Since I also desire to make statistical comparisons of effects between individuals who differ on characteristics of interest, I specify models with interaction terms (see Pedhazur, 1997, p. 411). For example, this strategy allows me to comment on whether the effect of a leadership position is greater for men than for women.

In the fourth analysis section, I again use logistic regression on subgroups of the sample. I divide the sample into two groups according to whether an individual held a rated Air Force Specialty Code (AFSC) or a non-rated AFSC, and I estimate the effect of participating in a cadet leadership position for each group.

In the fifth and final analysis section, I continue to make use of logistic regression to analyze the relationship between leadership-related admission variables and selection for cadet leadership positions. A set of bivariate logistic regressions testing the predictive relationship between admission variables and participation in a cadet leadership position are specified. Additionally, multivariate models containing several admission variables as predictors of participation in a cadet leadership position are specified. The multivariate models allow me to isolate the influence of a specific piece of admission information on the probability of participating in a cadet leadership position while accounting for the possible influence of other important admission and demographic variables. Raw correlations between admission variables and cadet leadership participation are also calculated and presented.

4. Results And Discussion

Research Question 1:

Do cadets selected for Academy leadership positions have higher Academy military, academic, and athletic performance scores than cadets not selected for leadership positions prior to being selected as leaders?

Summary of Findings

- Cadets holding line and aviation positions had significantly higher Academy military, academic, and athletic performance scores prior to being selected as leaders than the cadets not holding line and aviation positions respectively
- Cadets holding summer composite group and CST cadre leadership positions had significantly lower Academy military, academic, and athletic performance scores prior to being selected as leaders than the cadets not holding summer composite group and CST cadre positions respectively

Introduction

Before I begin investigating the relationship between leadership position types and promotion, it is important to understand the quality of cadets who are selected for the different leadership positions at the Academy before they participate in the leadership position. Understanding how cadets holding a particular type of leadership position differ in performance before they are selected for the position from the cadets not holding that type of position will inform later analysis by illuminating the otherwise unknown selection procedure for leadership positions. Leadership positions examined in this dissertation are held only during junior or senior year at the Academy. As a result, the performance of cadets during their freshman and sophomore years is known prior to selection for these leadership positions. Because I want to focus on the performance information the individuals making selection decisions could likely access as part of

making their selection decisions, I examine performance scores averaged over the first two years of attendance at the Academy.

As indicated in the research question, cadets are assessed in three performance areas while at the Academy: military, academic, and athletic. Military performance average (MPA), grade point average (GPA)[8], and a count of the number of times an individual appears on the athletic merit list (AMC) are the measures of these respective performance areas used for this analysis. Each semester, membership on the athletic merit list is awarded to cadets with a physical education average (PEA) greater than or equal to 3.0 for that semester.[9]

Evidence of a higher performance score in any of these three areas for the cadets holding a particular type of leadership position compared to those not holding that particular type of leadership position may suggest that the selection procedure is based on merit. Evidence showing cadets holding a particular type of leadership do not differ on a performance score compared to those cadets not holding that particular type of leadership position may suggest the selection procedure is agnostic to that performance area. For example, if the cadets who hold line leadership positions have higher MPAs, GPAs, and AMCs than the cadets who did not hold a line leadership position, this result may suggest these pieces of performance information factor into the selection decision of who becomes a cadet line leader. Differences might also be due to the quality of the pool of cadets applying for the positions. For example, if cadets with the highest two-year performance scores apply for a specific position at a high rate, the cadets holding the position will likely have above average performance scores even if the selection process is not based on merit.

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[8] The 2-YR GPA used for this analysis was calculated as the simple average of four semester grade point averages and was not weighted by the number of credits taken in each semester.

[9] While the PEA is the preferred athletic performance score, since it is a continuous measure and thus better differentiates performance than the athletic merit list count, these data were unavailable for the class years included in this analysis.

Differences in prior performance between those selected as leaders and those not selected as leaders need to be accounted for in the analysis of the relationship between leadership positions and promotion. For example, if the cadets holding line leadership positions have higher average military performance scores than the cadets not holding line leadership positions, this difference could confound the relationship between holding a line leadership position and later promotion such that holding a line leadership position would appear to have a strong relationship with later promotion when in fact the later promotion is instead due to the relationship between military performance average and promotion.

Data Used

The sample used for this analysis includes U.S. Air Force Academy graduates for class years 1983 to 1995 commissioned into the U.S. Air Force whose first primary AFSC places them in the line competitive category.

A summary of the variables used in the analysis for this research question are listed in Table 4.1.1.[10] The variables are organized into two sections: a "Leadership Positions" section and an "Academy Performance Covariates" section. The leadership position variables are all indicator variables with a value of 1 indicating the position was held by the individual in the sample. The Academy performance covariates listed are the military, academic, and physical performance measures mentioned in the introduction to this question.

Methods Used

Basic descriptive analyses are used to address this research question. Academy academic, military, and athletic performance measure averages are calculated for each leadership position type. The averages for each performance measure are compared between those holding a

[10] For subsequent research question sections using additional data beyond what is listed in Table 1.2, the additional data will be presented and discussed in those sections.

particular leadership position and those not holding that leadership position using a two-tailed *t*-test with a Bonferroni-corrected significance level.[11,12] Confidence intervals are calculated around these average scores and are displayed graphically in Appendix B to convey the variability and sample size associated with these averages.

[11] Rice (2007) offers a more detailed description of using the *t*-statistic to test a two-sided alternative hypothesis, p. 425.

[12] Because multiple statistical hypotheses are tested on overlapping samples of the data, a Bonferroni-corrected significance level is used for determinations of statistical significance. The Bonferroni method simply requires dividing the desired type I error rate (alpha) by the number of hypotheses tested (Rice, 2007, p. 487).

Table 4.1.1
Summary of Variables Used In This Section

Variable	Abbreviation	Data Type[a]	Description
Leadership Positions			
Line Leader		D	1=cadet line position held , 0= not held
Aviation Leader		D	1=cadet aviation position held , 0= not held
Basic Cadet Training Cadre	BCT Cadre	D	1=BCT cadre position held , 0= not held
Athletic Team Captain		D	1=cadet team captain position held , 0= not held
Staff Leader		D	1=cadet staff position held , 0= not held
Air Education and Training Command Summer Cadre	AETC Cadre	D	1=AETC cadre position held , 0= not held
Combat Survival Training Cadre	CST Cadre	D	1=CST cadre position held , 0= not held
Summer Seminar Cadre		D	1=summer seminar cadre position held , 0= not held
Summer Composite Group Leader		D	1=summer composite group position held , 0= not held
Academy Performance Covariates			
Two-Year Grade Point Average	2-YR GPA	C	Average of an individual's first four semester GPAs at the Academy. Each semester is weighted equally regardless of credits taken
Two-Year Military Performance Average	2-YR MPA	C	Average of an individual's first four semester MPAs. The ability to communicate, encourage teamwork, motivate subordinates, accomplish assigned missions, inspire others, and resolve conflict are some of the concepts evaluated in the MPA.
Two-Year Athletic Merit List Count	2-YR AMC	C	Number of times an individual was on the Athletic Merit List during the first two years at the Academy.

[a] D=Dichotomous, C=Continuous

Results

Table 4.1.2 displays average performance scores for all cadets in four class year ranges: 1983-95, 1985-95, 1983-88, and 1989-91.[13] Average performance scores are also broken out by leadership position type within each range of class years. For example, the performance averages across from the first "Line" heading in column 1 include only cadets who held a line position at the Academy in class years 1983-95. The performance averages across from the "No Line" label include all cadets who did not hold a line position in class years 1983-95, even if they did hold another type of leadership position. Summing the number of cadets in the "Line" (1,994) and "No Line" (10,180) groups results in the total number of cadets in that class year range (12,174). The *p*-value from a two-tailed *t*-test comparing the difference between the leadership position average and the no leadership position average is listed in the column to the right of the two averages.

For each of the four class year ranges, charts are included in Appendix B (Figures B.1-B.12) showing the average value of the three performance measures for each leadership position type and its corresponding comparison group. For each class year range, one chart is included for each performance area for a total of three charts per class year range. The upper and lower bounds of a 95% confidence interval are displayed with horizontal dashes above and below the mean value which is indicated by a triangle.

Cadets holding line leadership positions had significantly higher average 2-YR MPA, 2-YR GPA, and 2-YR AMC than cadets not holding line leadership positions for all class year ranges. The consistent vertical distance between the line and no line values in Figures B.1-B.12 conveys this point visually. The fact that the confidence intervals around the mean values for the line and no line group do not overlap in

[13] For the second research question in this dissertation, four models using different samples of Academy class years are presented. Because this section informs the specification of those models, it is organized similarly.

the figures indicates that these differences are statistically significant at the $p<.05$ level. The exact p-value from a two-tailed t-test of these performance differences can be seen in Table 4.1.2.

Cadets holding aviation leadership positions had significantly higher average 2-YR MPA, 2-YR GPA, and 2-YR AMC than cadets not holding aviation leadership positions for all class year ranges. The consistent vertical distance between the aviation and no aviation values in Figures B.1-B.12 conveys this point visually.

Cadets holding BCT cadre leadership positions had significantly lower average 2-YR GPA for all class year ranges and significantly lower average 2-YR AMC for the class years 1983-95 and 1989-91 compared to cadets not holding BCT cadre leadership positions. The vertical distance between the BCT cadre and no BCT cadre values in Figures B.2, B.5, B.8, and B.11 conveys the difference in 2-YR GPA visually. The vertical distance between the BCT cadre and no BCT cadre values in Figures B.3 and B.12 conveys the difference in 2-YR AMC visually. Note that the no BCT cadre value is higher than the BCT cadre value in these cases which is a reversal of the pattern seen with the line and aviation positions.

Cadets holding athletic team captain positions had significantly lower average 2-YR GPA for the class years 1983-95, 1985-95, and 1989-91, and significantly lower average 2-YR AMC for the class years 1989-91 compared to cadets not holding athletic team captain positions. The vertical distance between the team captain and no team captain values in Figures B.2, B.5, and B.11 conveys the difference in 2-YR GPA visually. The vertical distance between the team captain and no team captain values in Figure B.12 conveys the difference in 2-YR AMC visually.

Cadets holding summer composite group positions had significantly lower average 2-YR MPA, 2-YR GPA, and 2-YR AMC compared to cadets not holding summer composite group positions for class years 1985-95. The vertical distance between the summer composite group and no summer composite group values in Figures B.4-B.6 conveys the difference in three performance areas visually.

Cadets holding summer seminar positions had significantly lower average 2-YR GPA than cadets not holding summer seminar positions for class years 1985-95. The vertical distance between the summer seminar group and no summer seminar group values in Figure B.5 conveys the difference in 2-YR GPA visually.

Cadets holding AETC cadre positions had significantly higher average 2-YR MPA and significantly lower average 2-YR GPA than cadets not holding AETC cadre positions for class years 1985-95. The vertical distance between the AETC cadre group and no AETC cadre group values in Figure B.4 and B.5 conveys the difference in 2-YR MPA and 2-YR GPA visually. Note that the average 2-YR MPA for those holding an AETC cadre position was higher than those not holding an AETC cadre position, while the average 2-YR GPA for those holding an AETC cadre position was lower than those not holding an AETC cadre position. Only the AETC cadre position showed this finding where one performance measure was significantly higher and another performance measure was significantly lower than the comparison group.

Cadets holding CST cadre positions had significantly lower average 2-YR MPA, 2-YR GPA, and 2-YR AMC than cadets not holding CST cadre positions for class years 1985-95. The vertical distance between the CST cadre group and no CST cadre group values in Figures B.4-B.6 conveys the difference in 2-YR MPA, 2-YR GPA, and 2-YR AMC visually.

Cadets holding staff leadership positions had significantly higher average 2-YR MPA and 2-YR AMC than cadets not holding staff leadership positions for class years 1989-91. The vertical distance between the staff and no staff group values in Figures B.10 and B.12 conveys the difference in 2-YR MPA and 2-YR AMC visually.

Table 4.1.2
Academy Performance Measure Means by Leadership Position Type

Leadership Position Type	*n*	Two Year MPA Mean[a]	*p*-value[b]	Two Year GPA Mean[a]	*p*-value[b]	Two Year Athletic List Mean[a]	*p*-value[b]
Class Years 1983-95	12,174	2.89		2.81		.96	
Line	1,994	3.13*		2.98*		1.64*	
No Line	10,180	2.84	.000	2.77	.000	.83	.000
Aviation	950	3.05*		3.18*		1.74*	
No Aviation	11,224	2.88	.000	2.78	.000	.90	.000
BCT Cadre	9,148	2.88		2.79*		.94*	
No BCT Cadre	3,026	2.89	.106	2.87	.000	1.04	.000
Team Captain	281	2.91		2.70*		.99	
No Team Captain	11,893	2.89	.154	2.81	.000	.96	.699
Class Years 1985-95	10,263	2.89		2.81		.97	
Line	1,701	3.13*		2.97*		1.62*	
No Line	8,562	2.84	.000	2.78	.000	.84	.000
Aviation	856	3.05*		3.18*		1.71*	
No Aviation	9,407	2.88	.000	2.78	.000	.90	.000
BCT Cadre	7,861	2.90*		2.80*		.96	
No BCT Cadre	2,402	2.87	.001	2.87	.000	1.01	.069
Team Captain	276	2.91		2.70*		.99	
No Team Captain	9,987	2.89	.209	2.82	.000	.97	.805
Summer Composite Group	1,438	2.82*		2.72*		.75*	
No Summer Composite Group	8,825	2.90	.000	2.83	.000	1.00	.000

Table 4.1.2–Continued

Leadership Position Type	*n*	Two Year MPA Mean[a]	*p*-value[b]	Two Year GPA Mean[a]	*p*-value[b]	Two Year Athletic List Mean[a]	*p*-value[b]
Summer Seminar	262	2.90		2.93*		1.03	
No Summer Seminar	10,001	2.89	.404	2.81	.000	.97	.431
AETC Cadre	376	2.99*		2.75*		.97	
No AETC Cadre	9,887	2.89	.000	2.81	.014	.97	.924
CST Cadre	4,773	2.81*		2.75*		.75*	
No CST Cadre	5,490	2.96	.000	2.86	.000	1.16	.000
Class Years 1983-88	5,609	2.88		2.78		.92	
Line	892	3.12*		2.97*		1.68*	
No Line	4,717	2.84	.000	2.75	.000	.78	.000
Aviation	365	3.05*		3.21*		1.92*	
No Aviation	5,244	2.87	.000	2.75	.000	.86	.000
BCT Cadre	4,201	2.89*		2.77*		.91	
No BCT Cadre	1,408	2.86	.001	2.83	.000	.97	.138
Team Captain	59	2.90		2.70		.86	
No Team Captain	5,550	2.88	.579	2.78	.200	.93	.710
Staff	1,086	2.88		2.77		.94	
No Staff	4,523	2.88	.877	2.79	.334	.92	.757
Class Years 1989-91	2,786	2.91		2.82		.96	
Line	485	3.15*		2.97*		1.63*	
No Line	2,301	2.86	.000	2.79	.000	.82	.000
Aviation	254	3.07*		3.14*		1.67*	
No Aviation	2,532	2.89	.000	2.79	.000	.89	.000
BCT Cadre	2,155	2.90		2.80*		.91*	
No BCT Cadre	631	2.93	.060	2.89	.000	1.14	.000
Team Captain	86	2.89		2.70		.63*	
No Team Captain	2,700	2.91	.458	2.82	.025	.97	.011

Table 4.1.2–Continued

Leadership Position Type	*n*	Two Year MPA Mean[a]	*p*-value[b]	Two Year GPA Mean[a]	*p*-value[b]	Two Year Athletic List Mean[a]	*p*-value[b]
Staff	612	2.97*		2.84		1.12*	
No Staff	2,174	2.89	.000	2.81	.313	.92	.001

[a] Since multiple statistical hypotheses are tested on overlapping samples of the data, a Bonferroni corrected significance level of .002 (.05/(22 tests of significance in each column)) is advised for determination of statistical significance. Mean Academy performance values for the leader groups that differ significantly from the non-leader group at this significance level have been starred (*).
[b] p-values presented are for a two-tailed *t*-test comparing the difference in mean values of the variable for individuals holding the leadership position type compared to the mean value for not holding the position type.

Discussion

Only the line and aviation leadership position types showed significantly higher averages in all three performance areas compared to their respective comparison groups. The summer composite group and CST cadre leadership position types were the only types that showed significantly lower averages in all three performance areas compared to their respective comparison groups. It is likely that both the performance factors considered in selection decisions and cadet preferences impacted these average performance scores. Selection for certain positions may have valued better performers on a specific measure more than another position. Another possibility is that positions may have attracted different quality applicants. The higher performance averages for the line and aviation position types may suggest a merit-based selection process that values military, academic, and physical performance scores. It may also suggest cadets with high performance averages applied for the aviation and line positions at higher rates than for other positions. The lower performance averages for the summer composite group position and CST cadre position may suggest a low cadet preference for these leadership position types. If cadets generally preferred aviation and line positions and those positions were awarded based on merit, the cadets in summer composite group and CST cadre positions may have preferred to hold one of those positions but were not selected.

While this analysis clarifies how performance measures of cadets in leadership positions differ, it does not explain why these differences exist. To understand why the differences exist, it is necessary to have information about cadet preferences and the rules used for selection. Such data were not available for this analysis.

The existence of significant differences between leader and non-leader groups for military, academic, and athletic performance measures supports the argument that cadets are not randomly assigned to leadership positions. Consequently, cadet leadership positions should not be studied assuming any natural experiment structure. Modeling the impact of holding a cadet leadership position on officer promotion

requires controlling for ways in which cadets holding a particular leadership position differ from cadets not holding that particular leadership position. Academy performance is one of the ways cadets holding certain leadership positions differ from cadets hot holding those leadership positions. Therefore, two-year performance measures are be included as control variables in the next section’s models along with additional control variables.

RESEARCH QUESTION 2:

Participation in which types of cadet leadership positions shows a statistically significant association with promotion to at least the rank of Lieutenant Colonel after controlling for relevant and available covariates such as Academy GPA?

Summary of Findings

- Before controlling for demographic, application, and Academy performance covariates, the probabilities of promotion for cadets participating in line, aviation, AETC cadre, and staff positions were significantly higher than the probabilities of promotion for cadets who did not participate in line, aviation, AETC cadre, or staff positions respectively
- After controlling for covariates, the line and staff position types showed significant and positive associations with promotion

Introduction

Seeking to prepare cadets for the responsibilities they later face as officers, the Air Force Academy offers cadets opportunities to practice leadership in a variety of contexts. This section investigates the association between types of cadet leadership positions and promotion to the rank of at least Lieutenant Colonel. If cadet leadership positions do prepare cadets for the leadership responsibilities they later encounter as officers, I expect to see an association between the leadership positions and a signal of effective officership like promotion. Unique characteristics of the positions showing a relationship with promotion can be used by the Academy in their design of curricula for leadership position experiences.

As was shown previously, cadet leadership positions are not distributed to cadets randomly. Average performance values for cadets in some leadership positions were higher or lower than the group of cadets not holding those leadership positions. This may have been the result of a combination of merit-based selection processes and cadet

preferences. Isolating the association between participation in a leadership position and promotion to Lieutenant Colonel to the greatest extent possible strengthens the relevance of this research in terms of understanding the value of different leadership opportunities. Therefore, it is necessary to account for differences between individuals holding a cadet leadership position and those who did not hold that leadership position to avoid the influence of confounders on the association of interest.

To address this research question, a series of nine hypotheses are tested:

Hypothesis 1: Compared to other commissioned Academy graduates not holding a cadet line leadership position, past cadet line leaders showed a statistically significant advantage in promotion to the rank of Lieutenant Colonel, controlling for group differences.[14]

$$H_0: \beta_{Line} = 0$$

$$H_1: \beta_{Line} > 0$$

Identical hypotheses for the following additional leadership positions will be tested:

Hypothesis 2: Aviation

Hypothesis 3: Basic Cadet Training Cadre

Hypothesis 4: Athletic Team Captain

Hypothesis 5: Staff

Hypothesis 6: Summer Composite Group

Hypothesis 7: Summer Seminar Cadre

Hypothesis 8: Air Education and Training Command Cadre

Hypothesis 9: Combat Survival Training Cadre

[14] Three categories of covariates are included in the models to control for group differences: Academy performance covariates (shown in Table 4.1.1), demographic covariates (shown in Table 4.2.1), and application covariates (shown in Table 4.2.1).

Data Used

The leadership position variables and the Academy performance measures described for the previous research question are again used in this analysis. The Academy performance measures from the last section are used along with demographic and application measures as covariates in this section's promotion models. Demographic and application covariates are described in Table 4.2.1 along with the promotion outcome variable. Descriptions of the Academy performance covariates and leadership position variables are not shown in Table 4.2.1, since those measures were detailed previously in Table 4.1.1. Demographic covariates include information about age, race, gender, career field, graduation year, and military exposure prior to entering the Academy. Application covariates include admission composites and ACT/SAT concordance score.

In the data provided by the Academy, some leadership positions were only included for a portion of the class years in the sample. As a result, it is necessary to construct four separate models covering different time periods in order to test the desired hypotheses. A list of the class years and leadership positions included in each of the four models is shown in Table 4.2.2. Model 1 contains the largest sample. The sample is reduced from Model 1's size for the other models in order to include additional positions where the data were available. For example, the dataset only includes executive officer staff positions for class years 1989-1991, so a model is specified for only these three class years in order to compare other positions to the executive officer staff positions. Since cadets can hold several leadership positions over the course of their time at the Academy, it is important to account for confounding resulting from holding multiple positions. For example, an indicator for holding an AETC cadre position is not included in Model 1 but is correlated with holding a line position. Therefore, Model 2 is specified with a reduced sample size but includes the AETC cadre indicator which was omitted from Model 1 due to missing data. Model 2 is therefore necessary to exclude the possibly confounding influence of AETC cadre participation from the effect estimate for the line position type. All four models contain

line, aviation, BCT cadre, and athletic team captain positions. These positions are among the most prestigious at the Academy, so the fact that data for these positions are available for each model is advantageous.

Sample proportions for discrete variables used in the four models are displayed in Table 4.2.3. In general, the proportions are consistent across the models, with a few exceptions. A smaller proportion of cadets were recorded as being team captains for the Model 3 sample, which covers class years 1983-88, than the other three model samples. Also, the proportion of cadets entering rated career fields immediately after graduation is higher in the Model 3 sample than in the other three model samples. Means and standard deviations for continuous variables used in the four models are displayed in Table 4.2.4. In general, the means and standard deviations for these variables are consistent across the four models.

Methods Used

To test the nine hypotheses presented previously, two methodological approaches are used: logistic regression and propensity weighted logistic regression. First, logistic regression is performed using promotion to Lieutenant Colonel as an outcome with leadership position indicator variables and Academy performance, applicant, and demographic covariates as predictors. A logit link function is applied to the probability of being promoted, and the transformed result is assumed to have a linear relationship with the predictor variables used in the models (Pedhazur, 1997, p. 717).[15] The maximum likelihood estimation procedure is used to provide the most likely estimates of the population parameters (Pedhazur, 1997, p. 718). Coefficients for the independent variables from the logistic regression are transformed into average marginal effects representing percentage point changes in

[15] The logit of a promotion probability p is given by the formula: $logit(p) = log\left(\frac{p}{1-p}\right)$

the conditional probability of promotion for a unit change in the variable of interest (see Cameron and Trivedi, 2005, p. 470).

Raw correlations between predictors used in the models and the promotion outcome are presented in tables in Appendix C. In addition, power analysis is conducted for each of the logistic regression models based on the characteristics of the sample including size, probability of holding a leadership position, and promotion probability in order to clarify the detectable effect sizes for the leadership position types examined. Faul et al. (2009, p. 1157) provided a more detailed description of the power calculation for a logistic regression.

Results from the logistic regression models indicate statistically significant associations between leadership positions and promotion while holding the covariates constant. This information is used to direct the focus of subsequent propensity weighted logistic regressions.

Propensity weighted logistic regression is employed to strengthen the causal inference that can be drawn from results. The propensity weighted logistic regression methodology attempts to balance confounding variables between individuals holding a particular cadet leadership position and individuals not holding that leadership position. The propensity weighted logistic regression method involves performing two logistic regressions. The first logistic regression uses the variables thought to affect selection into the training group (in this case the training group is defined as holding a type of cadet leadership position) as predictors of a variable indicating membership in the training group. The predicted probabilities from this regression are called “propensity scores,” and these scores can then be used as weights in a subsequent bivariate logistic regression with membership in the training group as the independent variable and the outcome of interest (in this case promotion) as the dependent variable (Berk, 2004, p. 230). The estimates from the second regression can then be interpreted as unbiased estimates of the average treatment effect of receiving training to the extent that all variables related to training selection and the outcome are included and are measured without error (Berk, 2004, p. 230).

It should be noted that leadership position indicators other than the leadership position specifically being tested will act as predictors of the leadership position being tested in the first regression used to generate the weights. For example, when examining the effect of a line position, the aviation position indicator will be used to predict participation in a line position.

Performing the propensity weighting method requires verifying that the propensity weights balance the covariates between the group holding a leadership position of interest and the group not holding that type of leadership position. I use both individual *t*-tests and Hotelling's joint *T*-squared test to verify if the propensity weights balance the means of the covariates between the group of cadets holding the leadership position of interest and the group of cadets not holding the position of interest. Hotelling's *T*-squared test is designed to jointly test whether two vectors of mean values are equal. Hotelling's *T*-squared statistic is calculated with the following equation, where $\boldsymbol{S}_P$ is a pooled estimate of the common variance-covariance matrix (Rencher, 2002, p. 118):

$$T^2 = (\bar{x}_1 - \bar{x}_2)' \left\{ \boldsymbol{S}_p \left(\frac{1}{n_1} + \frac{1}{n_2} \right) \right\}^{-1} (\bar{x}_1 - \bar{x}_2)$$

I then transform Hotelling's *T*-squared statistic to an *F*-statistic (*p* is the number of variables tested) (Rencher, 2002, p. 119):

$$F = \frac{n_1 + n_2 - p - 1}{p(n_1 + n_2 - 2)} T^2$$

After calculating Hotelling's *T*-squared statistic and converting it to an *F*-statistic, I test the hypothesis that the vector of covariate means for the group of cadets holding a particular leadership position type is equal to the vector of covariate means for the group of cadets not holding that leadership position type (Rencher, 2002, p. 117).

To verify whether the set of propensity weights generated balances the standard deviations of the covariates between the group of cadets holding the leadership position of interest and the group of cadets not

holding the position of interest, I use ratio *F*-tests (StataCorp, 2009, p. 1692). The calculation of the test statistic (which is distributed as *F* with n_x-1 and n_y-1 degrees of freedom) for a comparison between group x and group y is calculated as follows (StataCorp, 2009, p. 1692):

$$F = \frac{s_x^2}{s_y^2}$$

Table 4.2.1
Summary of Variables Used In This Section That Have Not Been Described Previously

Variable	Abbreviation	Data Type[a]	Description
Demographic Covariates			
Gender		D	A value of 1 for this variable indicates the individual is male (0=female).
Race		CT	A value of 1 for this variable indicates the individual is Caucasian (2=black, 3=Hispanic, 4=Asian, and 5=other).
Entry Age	Entry Age	C	This variable is the age of each individual at time of entry to the Academy.
Region		CT	A value of 1 for this variable indicates the individual attended high school in the Northeast U.S. Census region (2=Midwest, 3=South, 4=West, 5=Other).
Year Group		CT	A value of 1 for this variable indicates the individuals graduating class year was either 1983 or 1984 (2=1985-86, 3=1987-89, 4=1990-92, 5=1993-95).
Career Field Group		CT	A value of 1 for this variable indicates an individual's first assigned primary Air Force Specialty Code (AFSC) falls into the Rated career field group as specified by AFI 11-402 (2=Nonrated Operations, 3=Mission Support).
Prior Active Duty Regular Service	Prior ADR	D	A value of 1 for this variable indicates an individual was on active duty regular status in the U.S Armed Forces before entering the Academy.
Prep School	Prep School	D	A value of 1 for this variable indicates an individual attended a military preparatory school before entering the Academy.
Military Academy Sibling	Acad Sib	D	A value of 1 for this variable indicates an individual had a sibling who attended a U.S. service Academy.
Military Academy Parent	Acad Par	D	A value of 1 for this variable indicates an individual had a parent who attended a U.S. service Academy
Military Parent	Mil Par	D	A value of 1 for this variable indicates an individual had a parent who served in any branch of the U.S. military.
Application Covariates			
ACT/SAT Concordance Score	ACT/SAT Con	C	This variable indicates the highest ACT or SAT score submitted by an individual when applying to the Academy. ACT and SAT scores are placed on the same scale using concordance tables published by the College Board.
Prior Academic Record	PAR	C	This variable is a composite score calculated by the Academy Admissions Department using information about an applicant's high school academic record such as class rank, GPA, and courses taken.
Leadership Composite	Lead Comp	C	This variable, calculated by the Academy Admissions Department, combines information about high school leadership activities.
Candidate Fitness Assessment	CFA	C	This variable is an applicant's score on the Candidate Fitness Assessment which includes events such as pushups, situps, and pullups.
Selection Panel Rating	Sel Panel Rtg	C	This variable is the average of a set of Academy officials' ratings of an applicant after reviewing parts of the individual's application such as teacher evaluations, recommendation letters, interview scores, a writing sample, and fitness scores.
Outcome			
Lieutenant Colonel	LTC	D	A value of 1 for this variable indicates an individual was promoted to at least the rank of Lieutenant Colonel.

[a] D=Dichotomous, C=Continuous, CT=Categorical

Table 4.2.2
Leadership Positions Included in The Four Models Predicting Promotion to LTC

	Model 1	Model 2	Model 3	Model 4
Graduating Class Years Included	1983-1995	1985-1995	1983-1988	1989-1991
Positions Included				
Line	X	X	X	X
Wing Commander	X	X	X	X
Vice Wing Commander	X	X	X	X
Group Commander	X	X	X	X
Squadron Commander	X	X	X	X
Squadron Director of Operations	X	X	X	X
Aviation	X	X	X	X
Soaring Instructor	X	X	X	X
Jump Instructor	X	X	X	X
Powered Flight Instructor		X		
BCT Cadre	X	X	X	X
Athletic Team Captain	X	X	X	X
AETC Cadre		X		
CST Cadre		X		
Summer Seminar		X		
Composite Group		X		
Staff			X	X
Wing Executive Officer			X	X
Wing Character Officer			X	X
Wing Director of Safety				X
Group Executive Officer				X

Table 4.2.2-Continued

	Model 1	Model 2	Model 3	Model 4
Group Honor Chairman			X	X
Squadron Executive Officer				X
Squadron Athletic Officer			X	
Squadron Chief of Standardization and Evaluation			X	X
Squadron Chief of Training			X	X

Table 4.2.3
Sample Proportions for Discrete Variables Used in the Four Models

Variable	Model 1 Proportions (*n*=12,174)	Model 2 Proportions (*n*=10,263)	Model 3 Proportions (*n*=5,609)	Model 4 Proportions (*n*=2,786)
Leadership Positions				
Line	16.4%	16.6%	15.9%	17.4%
Aviation	7.8%	9.3%	6.5%	9.1%
BCT Cadre	75.1%	76.6%	74.9%	77.4%
Team Captain	2.3%	2.7%	1.1%	3.1%
Staff	-	-	19.4%	22.0%
Composite Group	-	14.0%	-	-
Summer Seminar	-	2.6%	-	-
AETC Cadre	-	3.7%	-	-
CST Cadre	-	46.5%	-	-
Covariates				
Gender	88.6%	88.6%	88.6%	88.4%
Race	-	-	-	-
Caucasian	85.2%	85.3%	84.9%	87.3%
Black	6.5%	6.5%	6.8%	6.0%
Hispanic	4.6%	4.5%	4.5%	3.5%
Asian	3.1%	3.2%	3.3%	2.7%
Other	.6%	.6%	.5%	.5%
Region	-	-	-	-
Northeast	17.3%	16.7%	19.4%	16.6%
Midwest	24.8%	25.2%	24.3%	25.3%
South	31.4%	32.0%	28.3%	32.5%
West	24.2%	23.9%	25.4%	23.7%
Other	2.3%	2.1%	2.6%	1.9%

Table 4.2.3-Continued

Variable	Model 1 Proportions	Model 2 Proportions	Model 3 Proportions	Model 4 Proportions
Year Group	-	-	-	-
1983-84	15.7%	-	34.1%	-
1985-86	15.0%	17.8%	32.6%	-
1987-89	22.9%	27.2%	33.3%	33.1%
1990-92	23.7%	28.1%	-	66.9%
1993-95	22.7%	26.9%	-	-
Career Field Group	-	-	-	-
Rated	47.5%	45.0%	58.6%	43.4%
Nonrated Operations	9.7%	10.4%	8.6%	13.0%
Mission Support	42.8%	44.6%	32.8%	43.6%
Prior Service Active Duty Regular	2.8%	2.5%	3.2%	2.4%
Academy Sibling	9.4%	9.0%	10.4%	8.4%
Academy Parent	2.8%	3.0%	1.6%	3.7%
Military Parent	33.3%	34.5%	24.1%	47.4%
Prep School	16.3%	16.6%	14.6%	15.5%
Outcome				
Lieutenant Colonel	35.7%	36.5%	33.7%	34.5%

Table 4.2.4
Means and Standard Deviations for Continuous Variables Used in The Four Models

	Model 1 (*n*=12,174)		Model 2 (*n*=10,263)		Model 3 (*n*=5,609)		Model 4 (*n*=2,786)	
Variable	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
ACT/SAT Con	1,306.0	97.5	1,308.0	95.5	1,295.2	102.7	1,313.5	92.0
PAR	641.8	88.3	664.7	87.7	627.5	88.9	648.9	85.6
Lead Comp	1,673.0	183.4	1,685.3	183.4	1,616.7	167.6	1,674.8	181.7
CFA	509.3	87.0	504.8	87.4	522.7	81.6	500.4	88.6
Sel Panel Rtg	593.1	77.8	603.9	62.4	591.0	94.4	583.3	63.8
2-YR GPA	2.81	.48	2.81	.47	2.78	.49	2.82	.48
2-YR MPA	2.89	.28	2.89	.28	2.88	.28	2.91	3.85
2-YR AMC	.96	1.24	.97	1.23	.92	1.26	.96	1.24
Entry Age	18.0	.82	18.0	.81	18.0	.81	18.0	.82

Results

Model 1: Graduating Class Years 1983-1995. Model 1 contains the line, aviation, BCT cadre, and athletic team captain leadership position types for class years 1983-1995. Average promotion percentages by leadership position type for Models 1-4 are listed in Table 4.2.5. The group averages from Table 4.2.5 show cadet line and aviation leaders had significantly higher average promotion rates to Lieutenant Colonel than the total sample and the group not holding those respective positions *before controlling for other important covariates*.

Covariates are selected for inclusion in the model based on a theorized relationship with holding a cadet leadership position and officer promotion. Correlations between all of the variables included in Model 1 are listed in Table C.1 in Appendix C. Likewise, for Models 2-4 correlations between all of the variables in those models are listed in Tables C.2-C.4. Many of the covariates included correlated significantly with the leadership position type indicators and promotion to Lieutenant Colonel, which confirms the importance of their inclusion in the models in order to isolate the associations between leadership positions and promotion.

Suppose the probability that a cadet reaches the rank of Lieutenant Colonel takes the binary logit form and depends on a cadet's status as a leader at the Air Force Academy along with a vector **k** containing the Academy performance, demographic, and application covariates listed in column 1 of Table 4.2.6 (model specification for Models 2-4 is identical with the exception of a change in the leadership positions included according to data availability):

$$logit\,[\,P(LTC = 1|X)\,] = \beta_0 + \beta_{Line}X_{Line} + \beta_{Av}X_{Av} + \beta_{BCT}X_{BCT} + \beta_{TC}X_{TC} + \beta_{\boldsymbol{k}}X_{\boldsymbol{k}} + \varepsilon$$

LTC is a dichotomous variable for promotion to at least the rank of Lieutenant Colonel (1=promoted, 0=not promoted). β_{Line}, β_{AV}, β_{BCT}, $and\ \beta_{TC}$ are the coefficients of interest in this model. β_{Line} is interpreted as the average marginal effect of participating in a cadet line leadership position on the probability of reaching at least the rank of Lieutenant Colonel. β_{AV}, β_{BCT}, $and\ \beta_{TC}$ are interpreted in the same manner. Regression

results reported for Models 1-4 all refer to promotion to at least Lieutenant Colonel while controlling for the vector of covariates.

Maximum likelihood estimates for the coefficients in the model above are presented as average marginal effects in Table 4.2.6. The first column under the "Model 1" heading in Table 4.2.6 contains the coefficients for a model where the leadership position type indicators are used. The second column under the "Model 1" heading contains the coefficients for a model where the position type indicators are removed and the individual leadership position indicators are included. For example, the line position type contains five individual positions. The first column under the "Model 1" heading represents the average marginal effects when these five positions are grouped together with an indicator variable called "Line." The second column under the "Model 1" heading represents the average marginal effects when five indicator variables are included representing each of the five positions. The BCT cadre and athletic team captain indicators remain the same across the two specifications because they only contain one position each and thus cannot be aggregated or divided. This same approach of presenting the coefficients for the types and the individual positions comprising those types is also used for Models 2-4.

Of the four coefficients representing types of leadership positions, only the coefficient on the line position was statistically significant. Cadets holding a line position were 5.5 percentage points more likely than cadets not holding a line position to be promoted for class years 1983 to 1995. Coefficients on the control variables are listed below the "Leadership Positions" section in Table 4.2.6 for both the aggregated and divided specifications of Model 1.

Both the squadron commander position indicator and the squadron director of operations position indicator had a statistically significant positive association with promotion. Cadets holding a squadron commander position were 5.0 percentage points more likely than cadets not holding a squadron commander position to be promoted for class years 1983 to 1995. Cadets holding a squadron director of operations position were 6.7 percentage points more likely than cadets

not holding a squadron director of operations position to be promoted for class years 1983 to 1995.

Although individuals who held a cadet line position and individuals who held a cadet aviation position had significantly higher average promotion rates to Lieutenant Colonel before controlling for other covariates, using a multivariate model with control covariates produces a non-significant coefficient for the aviation position. Holding an aviation position was positively correlated with performance measures such as standardized test scores, applicant PAR score, 2-YR GPA, 2-YR MPA, and applicant leadership composite, which were all positively correlated with promotion to Lieutenant Colonel. When these variables are included in the model, the line position showed a significant association with promotion, but the aviation position did not.

Power Analysis. An equal number of cadets did not hold each leadership position type in the samples used for Models 1-4. For example, the proportion of each sample holding an athletic team captain position was much smaller than the proportion of each sample holding a BCT cadre position. As a result, it is important to understand the detectable effect size when interpreting the regression results. Table 4.2.7 shows the sample size necessary to detect a 3%, 5%, and 10% average marginal effect (corresponding to small, medium, and large practical effects) for each position type in each model. The line and team captain position types both had medium effect sizes in Model 1 (5.5% and 4.3% respectively). Model 1's sample size of 12,174 is sufficient to detect the effect size on the line position type, but is insufficient to detect the effect size on the team captain position type. For the athletic team captain position type, a sample size of over 30,000 would be necessary to detect a medium effect size. Model 1 does support the conclusion that a large effect did not exist for the team captain position in this sample.

Model 2: Class Years 1985-1995. Model 2 includes the line, aviation, BCT cadre, athletic team captain, summer composite group, summer seminar, AETC cadre, and CST cadre leadership position type indicators for class years 1985-1995. The average promotion percentage

for the cadet line, aviation, and AETC cadre groups were significantly higher than the total sample average and the respective groups not holding those positions *before controlling for other variables*. The average promotion percentage for the summer composite group and CST cadre positions were significantly lower than the total sample average and the respective groups not holding those positions.

Maximum likelihood estimates for Model 2's coefficients are presented as average marginal effects in Table 4.2.6. Consistent with Model 1, the coefficient on the line position was statistically significant and positive. Cadets holding a line position were 5.7 percentage points more likely than cadets not holding a line position to be promoted for class years 1985 to 1995.

Also consistent with Model 1, both the squadron commander position indicator and the squadron director of operations position indicator had statistically significant positive associations with promotion. Cadets holding a squadron commander position were 5.3 percentage points more likely than cadets not holding a squadron commander position to be promoted for class years 1985 to 1995. Cadets holding a squadron director of operations position were 6.7 percentage points more likely than cadets not holding a squadron director of operations position to be promoted for class years 1985 to 1995. It is not surprising that these results are consistent with Model 1, since Model 2 contains a similar sample of class years to the Model 1 sample. Model 2 includes summer composite group, summer seminar, AETC cadre, CST cadre, and powered flight instructor positions. Because the significance of the line position coefficient did not change and the magnitude of the coefficient changed only slightly with the addition of four position types to the model, I have greater confidence that the association between holding a line position and promotion was not confounded by the leadership positions added in Model 2 that were omitted from Model 1.

Although individuals who held a cadet aviation position and individuals who held an AETC cadre position had significantly higher average promotion rates to Lieutenant Colonel for class years 1985-1995, the coefficients for these positions from the logistic regression model were not significant. As in Model 1, the aviation position was

again positively correlated with several performance measures that were positively correlated with promotion to Lieutenant Colonel. Holding an AETC cadre position was positively correlated with 2-YR MPA which had the largest average marginal effect on promotion of any of the performance covariates in Model 2. It is possible the higher average promotion rate for those who held an AETC cadre position was driven by above average 2-YR MPAs for this group.

Power Analysis. The line and team captain position types had medium effect sizes in Model 2. The AETC cadre position type had a small effect size. Model 2's sample size of 10,263 is sufficient to detect the medium effect size on the line position type but is not sufficient to detect the medium effect size for the team captain position type or the small effect size for the AETC cadre position type.

Model 3: Class Years 1983-1988. Model 3 contains the line, aviation, BCT cadre, athletic team captain, and staff leadership position type indicators for class years 1983-1988. The average promotion percentages for the cadet line and staff position types were significantly higher than the total sample average and the respective groups not holding those position types *before controlling for other variables*. The main purpose for specifying Model 3 is to examine the coefficient on the staff position type and also determine how the addition of the staff indicator affects the coefficient on the line position.

Maximum likelihood estimates for Model 3's coefficients are presented as average marginal effects in Table 4.2.8. Consistent with Models 1 and 2, the coefficient on the line position indicator was significant and positive. Cadets holding a line position were 6.0 percentage points more likely than cadets not holding a line position to be promoted for class years 1983 to 1998. The coefficient on the staff position indicator was also significant. Cadets holding a staff position were 4.4 percentage points more likely than cadets not holding a staff position to be promoted for class years 1983 to 1988.

Effect sizes for the squadron commander and squadron director of operations positions were similar to Models 1 and 2. The average

marginal effect magnitude was similar to Model 1 for the squadron commander position, though a reduction in the sample size may have hindered a finding of significance for this position. The only significant individual position within the staff type aggregation was the squadron chief of training position. Cadets holding a squadron chief of training position were 8.8 percentage points more likely than cadets not holding a squadron chief of training position to be promoted for class years 1983 to 1988. This 8.8% average marginal effect was the largest average marginal effect for any of the individual leadership positions or aggregate types across all four models. Because the magnitude of the line position coefficient changed only slightly when staff positions were included in the model, I have greater confidence in the robustness of the finding of a significant association between holding a line position and promotion.

Power Analysis. The line, aviation, and staff positions in Model 3 had medium effect sizes. The team captain and BCT cadre position types had small effect sizes. Model 3's sample size of 5,609 is sufficient to detect the medium effect size for the line and staff position types but is insufficient to detect the medium sized effect for the aviation position type or the small sized effects for the team captain and BCT cadre position types.

Model 4: Graduating Class Years 1989-1991. Model 4 contains the line, aviation, BCT cadre, athletic team captain, and staff leadership position type indicators for class years 1989-1991. Only cadet line positions showed a significantly higher average promotion rate than the total sample average *before controlling for other variables*. The main purpose for specifying Model 4 is to examine a grouping of staff positions that is different from the staff grouping in Model 3. The staff grouping in Model 4 contains the wing director of safety, group executive officer, and squadron executive officer positions that were omitted due to missing data in the other models.

Maximum likelihood estimates for Model 4's coefficients are presented as average marginal effects in Table 4.2.8. The average marginal effect for the wing director of safety is omitted because the variable perfectly predicts the outcome.

Consistent with Models 1, 2 and 3, the coefficient on the line position indicator was significant and positive. Cadets holding a line position were 6.7 percentage points more likely than cadets not holding a line position to be promoted for class years 1989 to 1991. Effect sizes for the squadron commander and squadron director of operations positions were also similar to Models 1, 2 and 3, but only the coefficient on the squadron commander position was significant. A finding of significance for the squadron director of operations position was likely hindered by the smaller sample size for Model 4 compared to the other three models. The presence of a significant coefficient for the line position type indicator in Model 4 where additional staff positions are included that were omitted from the previous three models due to missing data further strengthens the finding of a significant association between holding a line position and promotion. Unlike Model 3, which covered class years 1983-1988, the squadron chief of training indicator was not significant and had an average marginal effect magnitude of half a percentage point.

Power Analysis. The line position type had a medium effect size, the team captain position type had a large effect size, and the aviation position type had a medium effect size in Model 4. Model 4's sample size of 2,786 is sufficient to detect the medium effect size for the line position type but is insufficient to detect the large effect size for the team captain position type or the medium effect size for the aviation position type.

Summary of Logistic Regression Findings. Collectively, the four models presented above provide consistent evidence of a significant association between holding a cadet line position and promotion. Accounting for a large percentage of the line position type group, the squadron commander and squadron director of operations positions showed significant associations with promotion when included in the models individually. Therefore, the association between the line position group and promotion can largely be attributed to the influence of these two position types. This point is not meant to suggest other line positions aside from squadron commander and squadron director of operations did not show an association with promotion individually. The

frequency counts for these positions were smaller per year compared to the squadron line positions, so the sample for this study is too small to detect a significant association for the wing commander, vice wing commander, and group commander positions individually. The four models also provide consistent evidence for the absence of a significant association between other types of leadership positions and promotion except for the aggregation of staff positions in Model 3 that contains the squadron chief of training position. The squadron chief of training position showed the largest average marginal effect on the likelihood of promotion of any leadership position examined across the four models.

Propensity Weighted Logistic Regression Models. From a policy perspective, it is more useful to know the causal effect of holding a leadership position on promotion instead of the association between a leadership position and promotion (Nichols, 2007, p. 507). Finding a causal effect verifies the effectiveness of holding the position itself and not just the selection procedure for the position. Because I desire a better approximation of the causal effect of holding a leadership position on promotion, I now proceed to a propensity weighted logistic regression analysis.

Propensity weighting seeks to equalize a treatment and control group on a set of covariates in order to estimate the causal impact of a treatment as if a randomized experiment was conducted (Nichols, 2007, p. 517). Including control covariates in a regression and interpreting the coefficients as causal effects is problematic. Logistic regression requires the assumption that the regression equation has a linear relationship with the logit form of the probability of the dependent variable (Bewick, Cheek, and Ball, 2005, pp. 112-18). Propensity weighted logistic regression does not require the set of control covariates used to predict holding a leadership position to have a linear relationship with the logit form of the probability of promotion (Zanutto, 2006, p. 85). For this reason, estimates from the propensity weighted regression model are less sensitive to an incorrect assumption about the form of the relationship between the control covariates and the outcome. Dehejia and Wahba (1999 p. 1053) found that propensity

analysis better estimates a known experimental effect than linear regression. The accuracy of the propensity approach relies on all variables differing between the treatment and control groups that affect the outcome being available and included in the model (Schonlau et al., 2006, p. 7; Morgan and Winship, 2007, p. 75). Estimates lose accuracy if variables differing between the treatment and control group and affecting the outcome are omitted from the model.

Because the line position type showed a significant positive association with promotion in all of the previous models examined, I now analyze this position type using propensity weighted logistic regression in order to produce an improved effect approximation for holding one of these positions. I perform a propensity weighted logistic regression for each of the samples from Models 1-4 to estimate the line position's average marginal effect on promotion and compare the effects to those from Models 1-4 that use unweighted logistic regression above. I also analyze the staff position group from Model 3 because it was the only other position type that showed a significant association with promotion. I perform a propensity weighted logistic regression on the sample from Model 3 and the average marginal effect is compared to the effect for the staff position type from the unweighted logistic regression above to see if the estimate from the propensity weighted model differs from the estimate from the un-weighted logistic regression.

Line Models. The propensity weighted logistic regression is performed in three steps. First, it is necessary to generate a set of weights for each of the four samples by using demographic, application, and academy performance covariates and the other leadership position type indicators to predict whether an individual held a line position. I calculate a set of probability estimates for holding a line position in the Model 1 sample using predicted values for each individual from the following model with a vector of **k** covariates (listed in column 1 of Table 4.2.6 beginning with "Demographic Covariates") that is identical to the covariates used in Model 1: (similar models are used to calculate the propensity weights for Models 2-4)

$$logit\,[\,P(Line = 1|X)\,] = \beta_0 + \beta_{Av}X_{Av} + \beta_{BCT}X_{BCT} + \beta_{TC}X_{TC} + X_{\boldsymbol{k}}\beta_{\boldsymbol{k}} + \varepsilon$$

The predicted probability of promotion for each individual from the model above is used to calculate a propensity weight (w_i) for each individual according to whether the individual was a line leader or was not a line leader in the sample (Nichols, 2008, p. 532):

$$w_i = \frac{\hat{p}}{1-\hat{p}}\ for\ Line = 0$$

$$w_i = 1\ for\ Line = 1$$

Second, once these weights are created, I verify that applying the weights balances the covariates between those individuals holding a line position and those individuals not holding a line position. Table 4.2.9 displays Hotelling's *T*-squared test results for each of the samples. The large *p*-values for each of the samples indicate the means of the covariates are balanced well by the propensity weights. Table 4.2.10 shows *t*-test comparisons of mean covariate values between the line and no line groups before and after propensity weighting for the Model 1 sample. The propensity weights balance the covariates such that the covariate means are not significantly different for those individuals holding a cadet line position compared to those individuals not holding a cadet line position for the Model 1 sample.

Nichols (2008, p. 535) noted that the distributions of covariates may differ between the control and treatment groups after propensity weighting even if the means of the covariates are similar. I use ratio *F*-tests to verify equality of variance between the line and no line after propensity weighting. Results from these tests are displayed in Table 4.2.11 for the Model 1 sample. The propensity weights balance variance in the covariates for almost all the covariates. The propensity weights calculated by predicting line in the Models 2-4 samples also balance all the covariate means, and most of the variances are not significantly different for those individuals holding a line position compared to those individuals not holding a line position.

Tables with the results from mean and variance balancing tests for the Models 2-4 samples are displayed in Appendix D.

Third, if I believe all important variables differing between the line and no line groups related to promotion are included, using these sets of weights in logistic regression allows for an interpretation of the coefficient on the line position as an average treatment effect for individuals holding a line position (Zanutto, 2006, p. 69). I believe most of the important variables differing between the line and no line groups related to promotion are included.[16] The covariates used to create the weights included demographic information and a breadth of performance measures. The propensity weights are applied as weights to the following model:

$$logit\,[\,P(LTC = 1|X)\,] = \beta_0 + \beta_{Line}X_{Line} + X_{\boldsymbol{k}}\beta_{\boldsymbol{k}} + \varepsilon\,[weight = w_i]$$

There is a debate in the literature about whether to include covariates as independent variables in the regression predicting the outcome of interest or to only include the predictor indicating treatment and the weights (Freedman, 2008, p. 402). Consequently, I specified one model with all covariates included and one model with only the indicator for line position and the weights. The results differed only slightly. I only present results from the model with covariates included.

Maximum likelihood estimates for the coefficients of line position from the propensity weighted regressions are listed in Table 4.2.14. Holding a cadet line leadership position increased an individual's probability of being promoted by 4.6 percentage points on average compared to individuals not holding a cadet line leadership position

[16] I hoped to include personality measures in the analysis, but these data were unavailable. There is some evidence that personality is related to leadership effectiveness (Bartone et al., 2009; Judge et al., 2002). Whether personality differs between the groups holding leadership positions and the groups not holding leadership positions is unknown. Adding personality data to these models would be a useful extension of this dissertation.

for the sample including class years 1983 to 1995. The magnitude of the effect is the same for the Model 2 sample with class years 1985-1995. This average effect is about 1 percentage point less than the estimates from Models 1 and 2 shown in Table 4.2.6.

Holding a cadet line leadership position increased an individual's probability of being promoted by 6.5 percentage points on average compared to individuals not holding a cadet line leadership position for class years 1983 to 1988. This average marginal effect is about half a percentage point less than the estimate from Model 3 shown in Table 4.2.8. The average marginal effect from a propensity weighted regression using the Model 4 sample is about 1.5 percentage points less than the estimate from Model 4 shown in Table 4.2.8. The average marginal effect from the propensity weighted regression on Model 4's sample is not statistically significant, but the Model 4 sample only includes three years of data.

Staff Model. A set of individual probability estimates for holding a staff position in the Model 3 sample are calculated from the following model with a vector of **k** covariates that is identical to the covariates used in the unweighted logistic model on this sample.

$$logit\,[\,P(Staff = 1|X)\,] = \beta_0 + \beta_{Line}X_{Line} + \beta_{Av}X_{Av} + \beta_{BCT}X_{BCT} + \beta_{TC}X_{TC} + \beta_{\boldsymbol{k}}X_{\boldsymbol{k}} + \varepsilon$$

The predicted probability of promotion for each individual from the model above is used to calculate a propensity weight (w_i) for each individual according to whether the individual was a staff leader or was not a staff leader in the sample:

$$w_i = \frac{\hat{p}}{1-\hat{p}}\ for\ Staff = 0$$

$$w_i = 1\ for\ Staff = 1$$

Table 4.2.9 displays the Hotelling's T-squared test result for the comparison of covariate means between the group holding staff positions and the group not holding staff positions for the Model 3 sample. The p-value close to 1 indicates the means of the covariates are balanced

well by the propensity weights. Table 4.2.12 shows *t*-test comparisons of mean covariate values between the staff and no staff groups before and after propensity weighting for the Model 3 sample. The propensity weights balance the covariates such that the covariate means are not significantly different for those individuals holding a cadet staff position compared to those individuals not holding a cadet staff position, as staff position is defined in Model 3. Table 4.2.13 shows the propensity weights mostly balance the covariates such that covariate variances are not significantly different when comparing individuals holding a staff position to individuals not holding a staff position after weighting.

Using the set of propensity weights in logistic regression allows for interpretation of the coefficient on the staff position as an average treatment effect for individuals holding a staff position. The propensity weights are applied as weights to the following model:

$$logit\,[\,P(LTC = 1|X_i)\,] = \beta_0 + \beta_{Staff}X_{Staff} + \varepsilon\,[weight = w_i]$$

Holding a cadet staff leadership position increased an individual's probability of being promoted by 4.4 percentage points on average compared to individuals not holding a cadet staff leadership position for class years 1983 to 1988.

The methodology of the propensity weighted regression allows for a more policy relevant interpretation of the finding than the unweighted logistic regressions. Interpretation of the average marginal effect changes from "a cadet line position was associated with" to "a cadet line position increased." Cadet line leadership positions still showed a consistent relationship with promotion when using propensity weighted regression. This adds confidence to my findings from Models 1-4 above. The combination of staff positions used in Model 3 also showed a relationship with promotion in both the unweighted and weighted regressions. Now that I have added confidence to my findings by exploring a different methodological approach, I move to a discussion of why the positive effect on promotion for cadet line and staff leadership positions exists.

Table 4.2.5
Promotion Rates to LTC by Leadership Position Type

	Model 1		Model 2		Model 3		Model 4	
Position Type	% Promoted to LTC	*p*-value	% Promoted to LTC	*p*-value[a]	% Promoted to LTC	*p*-value[a]	% Promoted to LTC	*p*-value[a]
Total Sample	35.7%	-	36.5%	-	33.7%	-	34.5%	-
Line	46.2%**	.000[a]	47.3%**	.000[a]	43.9%**	.000[a]	45.6%**	.000[a]
No Line	33.6%**	.000[b]	34.3%**	.000[b]	31.8%**	.000	32.2%**	.000[b]
Aviation	40.7%**	.002[a]	-	-	35.1%	.591[a]	36.6%	.497[a]
No Aviation	35.2%**	.001[b]	-	-	33.6%	.566	34.3%	.456[b]
Aviation (Model 2)	-	-	42.0%**	.001[a]	-	-	-	-
No Aviation (Model 2)	-	-	35.9%**	.001[b]	-	-	-	-
BCT Cadre	35.5%	.821[a]	36.3%	.843[a]	34.4%	.484[a]	34.2%	.803[a]
No BCT Cadre	36.1%	.548[b]	36.9%	.587[b]	31.7%	.064	35.7%	.485[b]
Team Captain	37.0%	.642[a]	37.0%	.866[a]	35.6%	.759[a]	37.2%	.602[a]
No Team Captain	35.6%	.634[b]	36.4%	.862[b]	33.7%	.757	34.4%	.591[b]
Staff (Model 3)	-	-	-	-	36.8%*	.046[a]	-	-
No Staff (Model 3)	-	-	-	-	32.9%*	.015	-	-
Staff (Model 4)	-	-	-	-	-	-	36.1%	.447[a]
No Staff (Model 4)	-	-	-	-	-	-	34.0%	.341[b]
Summer Group	-	-	33.7%*	.043[a]	-	-	-	-
No Summer Group	-	-	36.9%*	.020[b]	-	-		
Summer Seminar	-	-	35.9%	.846[a]	-	-	-	-
No Summer Seminar	-	-	36.5%	.843[b]	-	-		
AETC Cadre	-	-	41.5%*	.047[a]	-	-	-	-
No AETC	-	-	36.3%*	.039[b]	-	-		

CST Cadre	-	-	34.5%*	.021[a]	-	-	-	-
No CST Cadre	-	-	38.1%**	.000[b]	-	-		

NOTE: *p<.05, **p<.01

[a] These p-values are for a two-tailed t-test comparing the mean position type promotion rate to the mean total sample promotion rate. For example, the p-value in the 3rd column, 2nd row is a comparison between the line promotion rate in Model 1 (46.2%) and the total Model 1 sample promotion rate (35.7%).

[b] These p-values are for a two-tailed t-test comparing the mean promotion rate for people who held that position type to the mean promotion rate for the people who did not hold that position type. For example, the p-value in the 3rd column, 3rd row is a comparison between the line promotion rate in Model 1 (46.2%) and the no line promotion rate in Model 1 (33.6%).

Table 4.2.6
Academy Leadership Position Participation and Covariates as Predictors of Promotion to at Least Lieutenant Colonel Models 1 & 2: Logistic Regression

	Model 1			Model 2		
Variable	AME Grouped[a]	AME Divided[b]	*n*[c]	AME Grouped[a]	AME Divided[b]	*n*[c]
Total Sample	-	-	12,174	-	-	10,263
Leadership Positions	-	-	-	-	-	-
Line	5.5%**	-	1,994	5.7%**	-	1,701
Wing Commander	-	-2.6%	26	-	-11.7%	22
Vice Wing Commander	-	8.3%	23	-	6.8%	20
Group Commander	-	.6%	94	-	1.1%	81
Squadron Commander	-	5.0%**	953	-	5.3%**	808
Squadron Director of Ops	-	6.7%**	926	-	6.7%**	793
Aviation	-1.8%	-	950	-1.2%	-	957
Soaring Instructor	-	-1.6%	728	-	-1.1%	670
Jump Instructor	-	-2.6%	222	-	-4.8%	186
Powered Flight Instructor	-	-	-	-	3.0%	103
BCT Cadre	-.5%	-.5%	9,148	-.8%	-.8%	7,861
Team Captain	4.3%	4.3%	281	4.4%	4.4%	276
Composite Group	-	-	-	-1.2%	-1.2%	1,438
Summer Seminar	-	-	-	.2%	.2%	262
AETC Cadre	-	-	-	3.2%	3.1%	376
CST Cadre	-	-	-	-1.4%	-1.4%	4,773
Demographic Covariates	-	-	-	-	-	-
Gender	-	-	-	-	-	-
Female (Base Level)	-	-	1,392	-	-	1,174
Male	13.8%**	13.8%**	10,782	15.2%**	15.2%**	9,089
Race	-	-	-	-	-	-
Caucasian (Base Level)	-	-	10,368	-	-	8,749
Black	-9.0%**	-9.0%**	795	-8.6%**	-8.6%**	663
Hispanic	-2.2%	-2.2%	558	-3.0%	-3.0%	464

Table 4.2.6-Continued

Variable	Model 1 AME Grouped[a]	Model 1 AME Divided[b]	Model 1 *n*[c]	Model 2 AME Grouped[a]	Model 2 AME Divided[b]	Model 2 *n*[c]
Asian	-3.8%	-3.9%	378	-5.9%*	-6.0%*	325
Other	-4.2%	-4.2%	75	.8%	.9%	62
Region	-	-	-	-	-	-
Northeast (Base Level)	-	-	2,109	-	-	1,730
Midwest	-1.5%	-1.5%	3,018	-1.1%	-1.1%	2,581
South	-.9%	-.9%	3,824	-1.5%	-1.5%	3,287
West	-.9%	-.9%	2,949	-1.0%	-1.1%	2,450
Other	7.5%*	7.6%*	274	8.5%*	8.5%*	215
Class Years	-	-	-	-	-	-
1983-84	Base Level[e]	Base Level[e]	1,911	-	-	-
1985-86	2.8%	2.7%	1,830	Base Level[e]	Base Level[e]	1,830
1987-89	2.3%	2.3%	2,790	-.3%	-.3%	2,790
1990-92	4.4%**	4.4%**	2,880	2.0%	2.0%	2,880
1993-95	6.5%**	6.5%**	2,763	3.8%*	3.9%*	2,763
Career Field Group[f]	-	-	-	-	-	-
Rated (Base Level)	-	-	5,784	-	-	4,622
Nonrated Ops	4.8%**	4.8%**	1,181	4.8%**	4.8%**	1,065
Mission Support	-.5%	-.5%	5,209	-.7%	-.7%	4,576
Prior ADR	-1.4%	-1.3%	336	-2.9%	-2.9%	253
Prep School	2.9%*	2.9*	1,989	2.2%	2.2%	1,703
Academy Sibling	.6%	.6%	1,140	.2%	.1%	919
Academy Parent	1.2%	1.2%	337	.1%	.1%	304
Military Parent	3.0%**	3.0%**	4,054	3.7%**	3.7%**	3,542
Entry Age	-1.5%*	-1.5%*	-	-1.5%*	-1.5%	-
Application Covariates	-	-	-	-	-	-
ACT/SAT Concor[d]	1.0%*	1.0%	-	1.1%*	1.1%*	-
PAR[d]	1.2%*	1.2%*	-	1.5**	1.5%**	-
Lead Comp[d]	.4%	.5%	-	.6%	.6%	-
CFA[d]	-1.4%**	-1.4%**	-	-1.3%*	-1.3%*	-
Sel Panel Rtg[d]	-.5%	-.5%	-	.3%	.3%	-

Table 4.2.6-Continued

	Model 1			Model 2		
Variable	AME Grouped[a]	AME Divided[b]	*n*[c]	AME Grouped[a]	AME Divided[b]	*n*[c]
Academy Performance Covariates	-	-	-	-	-	-
2-YR GPA[d]	.5%	.5%	-	-.5%	-.5%	-
2-YR MPA[d]	5.5%**	5.6%**	-	5.5%**	5.6%**	-
2-YR AMC[d]	-.1%	-.1%	-	.1%	.0%	-

NOTE: *p<.05, **p<.01

[a] Average marginal effects (AME) presented for a regression model with leadership positions grouped by type.

[b] AME presented for a regression model with individual leadership positions included.

[c] Counts are presented for dichotomous and categorical variables.

[d] Average marginal effect multiplied by 1 standard deviation. Coefficients should be interpreted as the average marginal effect for a 1 standard deviation increase in the variable.

[e] Because the class years included in the models differ, the base level changes from the 1983-84 group for Model 1 to the 1985-86 group for Model 2.

[f] The rated group includes pilot, navigator, and air battle manager career fields. The nonrated ops group includes career fields like intelligence, space & missiles, airfield ops, weather, and cyberspace ops. The mission support group includes logistics, maintenance, support, acquisitions, and engineering career fields.

Table 4.2.7
Power Analysis for Leadership Position Types With Varying Effect Sizes

Position Type	*n*	Sample size needed to detect a 3% AME	Sample size needed to detect a 5% AME	Sample size needed to detect a 10% AME
Model 1	12,174			
Line Leader	1,994	14,452	5,250[a]	1,333[a]
Aviation Leader	950	27,520	9,979[a]	2,528[a]
BCT Cadre	9,148	10,680[a]	3,891[a]	995[a]
Team Captain	281	88,006	31,892	8,065[a]
Model 2	10,263			
Line	1,701	14,333	5,202[a]	1,321[a]
Aviation (Model 2)	957	23,423	8,495[a]	2,153[a]
BCT Cadre	7,861	11,131	4,055[a]	1,037[a]
Team Captain	276	75,552	27,381	6,925[a]
Composite Group	1,438	16,442	5,966[a]	1,514[a]
Summer Seminar	262	79,584	28,841	7,294[a]
AETC Cadre	376	56,096	20,332	5,144[a]
CST Cadre	4,773	7,995[a]	2,908[a]	743[a]
Model 3	5,609			
Line	892	14,817	5,377[a]	1,365[a]
Aviation	365	32,512	11,788	2,985[a]
BCT Cadre	4,201	10,611	3,866[a]	988[a]
Team Captain	59	190,305	68,955	17,430
Staff (Model 3)	1,086	12,697	4,609[a]	1,171[a]
Model 4	2,786			
Line	485	13,782	5,002	1,271[a]
Aviation	254	23,883	8,661	2,195[a]
BCT Cadre	2,155	11,389	4,149	1,061[a]
Team Captain	86	66,047	23,937	6,055
Staff (Model 4)	612	11,567	4,200	1,068[a]

NOTE: Sample size necessary to detect an effect differs by model because the proportions of individuals holding the leadership positions vary slightly between samples. All calculations use a one tailed *z*-test and assume an alpha error probability of .05, a power level of .8, a .35 probability of promotion given the leadership position type listed was not held, and a small correlation with other covariates. The formula used to calculate these sample sizes and an example calculation are shown in Appendix E.

[a] These effect sizes are detectable in this dissertation's models.

Table 4.2.8
Academy Leadership Position Participation and Covariates as Predictors of Promotion to at Least Lieutenant Colonel Models 3 & 4: Logistic Regression

	Model 3			Model 4		
Variable	AME Grouped[a]	AME Divided[b]	*n*[c]	AME Grouped[a]	AME Divided[b]	*n*[c]
Total Sample	-	-	5,609	-	-	2,786
Leadership Positions	-	-	-	-	-	-
Line	6.0%**	-	892	6.7%**	-	485
Wing Commander	-	13.1%	12	-	-14.1%	6
Vice Wing Commander	-	3.7%	10	-	19.5%	6
Group Commander	-	5.0%	42	-	-1.4%	23
Squadron Commander	-	4.5%	435	-	7.3%*	231
Squadron Director of Ops	-	7.9%**	412	-	6.4%	223
Aviation	-4.1%	-	365	-3.3%	-	254
Soaring Instructor	-	-7.0%*	254	-	-1.5%	206
Jump Instructor	-	2.4%	111	-	-8.7%	48
BCT Cadre	2.3%	2.1%	4,201	-1.5%	-1.3%	2,155
Team Captain	3.5%	3.5%	59	8.9%	8.9%	86
Staff	4.4%**	-	1,086	.8%	-	612
Wing Executive Officer	-	-2.9%	10	-	-10.6%	4
Wing Character Officer	-	-6.3%	3	-	-12.9%	4
Wing Director of Safety	-	-	-	-	omitted[e]	2
Group Executive Officer	-	-	-	-	-25.8%**	12
Group Honor Chairman	-	4.5%	37	-	-14.9%	19
Squadron Executive Officer	-	-	-	-	5.3%	165
Squadron Athletic Officer	-	1.5%	309	-	-	-
Squadron Chief of Stan and Eval	-	1.5%	335	-	-.2%	215
Squadron Chief of Training	-	8.8%**	416	-	.4%	218

Table 4.2.8-Continued

Variable	Model 3 AME Grouped[a]	Model 3 AME Divided[b]	Model 3 *n*[c]	Model 4 AME Grouped[a]	Model 4 AME Divided[b]	Model 4 *n*[c]
Demographic Covariates	-	-	-		-	-
Gender	-	-	-		-	-
Female (Base Level)	-	-	641	-	-	323
Male	13.4**	13.3%**	4,968	14.0%**	14.3%**	2,463
Race	-	-	-	-	-	-
Caucasian (Base Level)	-	-	4,762	-	-	2,432
Black	-11.1**	-11.1**	381	-7.3%	-6.8%	168
Hispanic	-3.9%	-4.1%	251	-4.8%	-5.1%	96
Asian	-3.8%	-3.9%	185	-4.0%	-4.7%	75
Other	-20.7%**	-20.9%**	30	12.0%	11.7%	15
Region	-	-	-	-	-	-
Northeast (Base Level)	-	-	1,086	-	-	462
Midwest	-1.6%	-1.5%	1,362	-2.1%	-1.9%	706
South	-.1%	-.1%	1,588	-2.0%	-2.0%	904
West	-.9%	-.9%	1,426	-.8%	-.6%	660
Other	2.4%	2.6%	147	19.0%**	18.6%**	54
Class Years	-	-	-	-	-	-
1983-84	Base Level[f]	Base Level[f]	1,911	-	-	-
1985-86	2.8%	2.9%	1,830	-	-	-
1987-89	4.9%**	4.9%**	1,868	Base Level[f]	Base Level[f]	922
1990-92	-	-	-	4.9%*	4.8%*	1,864
1993-95	-	-	-	-	-	-
Career Field Group[g]	-	-	-	-	-	-
Rated (Base Level)	-	-	3,288	-	-	1,208
Nonrated Ops	8.5%**	8.5%**	483	9.3%**	9.3%**	363
Mission Support	2.4%	2.4%	1,838	2.6%	2.7%	1,215
Prior ADR	-2.4%	-2.7%	181	5.7%	6.4%	68
Prep School	5.5%*	5.6%*	820	5.0%	5.0%	433
Acad Sib	2.5%	2.6%	583	-2.5%	-2.4%	235
Acad Par	1.1%	1.1%	90	-2.6%	-2.4%	102

Table 4.2.8-Continued

Variable	Model 3 AME Grouped[a]	Model 3 AME Divided[b]	Model 3 *n*[c]	Model 4 AME Grouped[a]	Model 4 AME Divided[b]	Model 4 *n*[c]
Military Parent	3.5%*	3.5%*	1,349	3.5%	3.5%	1,320
Entry Age	-2.1%*	-2.1%*	-	-1.1%	-1.0%	-
Application Covariates	-	-	-	-	-	-
ACT/SAT Concor[d]	0.0%	-.1%	-	2.6%*	2.7%*	-
PAR[d]	.4%	.5%	-	.6%	.6%	-
Lead Comp[d]	1.3%	1.2%	-	.2%	.3%	-
CFA[d]	-2.3%**	-2.3%**	-	-.8%	-.9%	-
Sel Panel Rtg[d]	-1.5%*	-1.4%	-	-.2%	-.2%	-
Academy Performance Covariates	-	-	-	-	-	-
2-YR GPA[d]	2.5%**	2.5%**	-	-1.3%	-1.3%	-
2-YR MPA[d]	4.1%**	3.9%**	-	6.5%**	6.7%**	-
2-YR AMC[d]	.4%	.4%	-	-.6%	-.7%	-

NOTE: *p<.05, **p<.01

[a] Average marginal effects (AME) presented for a regression model with leadership positions grouped by type.

[b] AME presented for a regression model with individual leadership positions included.

[c] Counts are presented for dichotomous and categorical variables.

[d] Average marginal effect multiplied by 1 standard deviation.

[e] The Wing Director of Safety position for the years in this sample perfectly predicts the outcome, so the variable is omitted.

[f] Because the class years included in the models differ, the base level changes from the 1983-84 group for Model 3 to the 1987-89 group for Model 2.

[g] The rated group includes pilot, navigator, and air battle manager career fields. The nonrated ops group includes career fields like intelligence, space & missiles, airfield ops, weather, and cyberspace ops. The mission support group includes logistics, maintenance, support, acquisitions, and engineering career fields.

Table 4.2.9
Hotelling's T-Squared Test Comparing Covariate Means Between Groups

Leadership Position Type	T^2	*F*	*p-value*
Line (Model 1)	20.11	.627	.950
Line (Model 2)	15.32	.436	.999
Line (Model 3)	17.55	.563	.976
Line (Model 4)	15.67	.517	.986
Staff (Model 3)	.30	.010	.999

NOTE: p-values are for an *F*-test testing the hypothesis that the vectors of means are equal for the two groups. A large p-value indicates that we fail to reject this null hypothesis.

Table 4.2.10
Comparison Means Between the Line and No Line Groups Before and After Propensity Weighting for the Model 1 Sample

Variable	No Line Position Mean[a]	Line Position Mean[a]	*p*-value[b]	No Line Position Mean (weighted)[a]	*p*-value[b]
Leadership Positions					
Aviation Leader	6.9%	12.4%	.000**	12.7%	.737
BCT Cadre	74.7%	77.5%	.008**	76.8%	.497
Team Captain	2.4%	1.6%	.022*	1.6%	.888
Demographic Covariates					
Male	87.8%	92.5%	.000**	92.8%	.691
Caucasian	84.7%	87.5%	.001**	87.9%	.592
Black	6.8%	5.1%	.004**	4.7%	.472
Hispanic	4.7%	3.8%	.071	3.4%	.406
Asian	3.1%	3.0%	.681	3.3%	.413
Other Race	.6%	.7%	.823	.6%	.856
Northeast	17.7%	15.5%	.022*	15.8%	.778
Midwest	24.8%	24.6%	.851	24.5%	.935
South	31.1%	32.9%	.106	32.9%	.999
West	24.1%	24.6%	.648	24.6%	.974
Other Region	2.2%	2.3%	.984	2.1%	.716
Year Group 83-84	15.9%	14.7%	.178	13.9%	.370
Year Group 85-86	15.1%	14.7%	.644	14.2%	.532
Year Group 87-89	22.8%	23.5%	.521	23.6%	.905
Year Group 90-92	23.6%	24.0%	.675	22.6%	.797
Year Group 93-95	22.6%	23.1%	.622	24.0%	.386
Rated	45.7%	56.9%	.000**	56.7%	.865
Nonrated Ops	10.2%	7.3%	.000**	7.1%	.672
Mission Support	44.2%	35.8%	.000**	36.2%	.688
Entry Age	18.0	18.1	.126	18.1	.927
Prior ADR	2.6%	3.4%	.053	3.4%	.932

Table 4.2.10-Continued

Variable	No Line Position Mean[a]	Line Position Mean[a]	*p*-value[b]	No Line Position Mean (weighted)[a]	*p*-value[b]
Prep School	16.7%	14.3%	.007**	14.1%	.809
Acad Sib	9.1%	10.6%	.029*	9.7%	.189
Acad Par	2.7%	3.2%	.189	3.3%	.818
Mil Par	32.9%	35.3%	.043*	35.1%	.892
Application Covariates					
ACT/SAT Concor	1304.8	1312.6	.001**	1316.3	.116
PAR	638.8	656.9	.000**	658.8	.381
Lead Comp	1667.0	1703.5	.000**	1704.8	.765
CFA	508.4	513.9	.010*	513.2	.751
Sel Panel Rtg	592.5	595.8	.087	595.5	.870
Academy Covariates					
2-YR GPA	2.78	2.98	.000**	2.99	.291
2-YR MPA	2.84	3.13	.000**	3.14	.058
2-YR AMC	.83	1.64	.000**	1.69	.160

NOTE: The * symbol signifies a statistically significant difference in means between the individuals in the no line position group and the line position group for that variable, *p<.05, **p<.01. Because the weight applied to the line group equals 1, the weighted mean for the line group equals the unweighted mean, so only the weighted values for the no line group are displayed.

[a] Dichotomous variables are presented as percentages of the sample by line and no line groups. Continuous variables are presented with means for the line and no line groups.

[b] p-values are from a two-tailed t-test comparing the mean for the no line group to the mean for the line group.

Table 4.2.11
Comparison of Standard Deviations Between the Line and No Line Groups Before and After Propensity Weighting for the Model 1 Sample

Variable	No Line Position SD	Line Position SD	*p*-value[a]	No Line Position SD (weighted)	*p*-value[a]
Leadership Positions					
Aviation Leader	.254	.330	.000**	.333	.504
BCT Cadre	.435	.418	.023*	.422	.540
Team Captain	.154	.126	.000**	.124	.333
Demographic Covariates					
Male	.327	.263	.000**	.259	.325
Caucasian	.360	.331	.000**	.326	.374
Black	.252	.219	.000**	.211	.032
Hispanic	.212	.192	.000**	.182	.004**
Asian	.174	.169	.115	.179	.002**
Other Race	.078	.081	.047*	.078	.106
Northeast	.381	.362	.004**	.365	.721
Midwest	.432	.431	.891	.430	.930
South	.463	.470	.369	.470	.984
West	.428	.431	.686	.431	.963
Other Region	.148	.149	.912	.144	.091
Year Group 83-84	.366	.354	.068	.346	.190
Year Group 85-86	.358	.354	.532	.349	.361
Year Group 87-89	.420	.424	.550	.425	.932
Year Group 90-92	.425	.427	.701	.429	.841
Year Group 93-95	.418	.422	.638	.427	.456
Rated	.498	.495	.748	.495	.989
Nonrated Ops	.302	.261	.000**	.256	.312
Mission Support	.497	.479	.044	.481	.884
Entry Age	.811	.841	.031	.858	.263
Prior ADR	.160	.182	.000**	.182	.772
Prep School	.373	.350	.000**	.348	.712

Table 4.2.11-Continued

Variable	No Line Position SD	Line Position SD	*p*-value[a]	No Line Position SD (weighted)	*p*-value[a]
Acad Sib	.288	.308	.000**	.296	.014*
Acad Par	.162	.176	.000**	.179	.403
Mil Par	.470	.478	.327	.477	.937
Application Covariates					
ACT/SAT Concor	98.4	92.7	.001**	97.2	.008**
PAR	88.4	86.6	.243	89.1	.107
Lead Comp	183.3	181.1	.505	188.8	.019*
CFA	86.9	87.3	.816	86.0	.385
Sel Panel Rtg	77.9	77.2	.576	70.7	.000**
Academy Covariates					
2-YR GPA	.473	.471	.853	.499	.001**
2-YR MPA	.257	.264	.105	.286	.000**
2-YR AMC	1.149	1.441	.000**	1.509	.009**

NOTE: The * symbol signifies a statistically significant difference in standard deviations between the individuals in the no line position group and the line position group for that variable, *p<.05, **p<.01. Because the weight applied to the line group equals 1, the weighted standard deviation for the line group equals the unweighted standard deviation, so only the weighted values for the no line group are displayed.

[a] p-values are from a two-tailed ratio f-test comparing the standard deviation for the no line group to the standard deviation for the line group. One p-value is presented for a comparison of the non-weighted standard deviations. Another p-value is presented for a comparison of the weighted standard deviations.

Table 4.2.12
Comparison of Means Between the Staff and No Staff Groups Before and After Propensity Weighting for the Model 3 Sample

Variable	No Staff Position Mean[a]	Staff Position Mean[a]	*p*-value[b]	No Staff Position Mean (weighted)[a]	*p*-value[b]
Leadership Positions					
Line	17.6%	8.7%	.000**	8.8%	.928
Aviation	6.3%	7.5%	.157	7.5%	.992
BCT Cadre	75.3%	73.2%	.152	73.3%	.927
Team Captain	.9%	1.7%	.029*	1.6%	.954
Demographic Covariates					
Male	88.1%	90.4%	.033*	90.4%	.998
Caucasian	84.7%	85.6%	.451	85.5%	.932
Black	6.7%	7.1%	.664	7.1%	.980
Hispanic	4.7%	3.5%	.083	3.6%	.928
Asian	3.3%	3.2%	.876	3.3%	.928
Other Race	.5%	.6%	.929	.6%	.958
Northeast	20.3%	15.4%	.000**	15.4%	.972
Midwest	23.9%	25.8%	.199	25.6%	.922
South	27.8%	30.4%	.091	30.5%	.929
West	25.4%	25.3%	.932	25.3%	.993
Other Region	2.5%	3.1%	.241	3.1%	.930
Year Group 83-84	34.6%	31.7%	.064	31.6%	.968
Year Group 85-86	31.6%	36.7%	.001**	36.7%	.966
Year Group 87-88	33.7%	31.6%	.181	31.7%	.933
Rated	58.5%	59.3%	.612	59.2%	.937
Nonrated Ops	8.7%	8.4%	.762	8.3%	.966
Mission Support	32.9%	32.3%	.726	32.5%	.914
Entry Age	18.0	18.0	.224	18.0	.930
Prior ADR	3.2%	3.3%	.855	3.3%	.995
Prep School	14.7%	14.3%	.719	14.3%	.996

Table 4.2.12-Continued

Variable	No Staff Position Mean[a]	Staff Position Mean[a]	*p*-value[b]	No Staff Position Mean (weighted)[a]	*p*-value[b]
Acad Sib	10.3%	11.0&	.498	11.0%	.958
Acad Par	1.7%	1.4%	.514	1.4%	.969
Mil Par	23.9%	24.8%	.537	25.1%	.839
Application Covariates					
ACT/SAT Concor	1296.5	1289.8	.052	1290.0	.959
PAR	627.5	627.2	.911	626.8	.906
Lead Comp	1615.2	1623.2	.154	1622.6	.916
CFA	521.4	528.2	.014*	527.9	.921
Sel Panel Rtg	590.2	594.4	.191	594.4	.998
Academy Covariates					
2-YR GPA	2.79	2.77	.334	2.77	.974
2-YR MPA	2.88	2.89	.877	2.89	.926
2-YR AMC	.92	.94	.757	.94	.944

NOTE: The * symbol signifies a statistically significant difference between the individuals in the no staff position group and the staff position group for that variable, *p<.05, **p<.01. Because the weight applied to the staff group equals 1, the weighted mean for the staff group equals the unweighted mean, so only the weighted values for the no staff group are displayed.

[a] Dichotomous variables are presented as percentages of the sample by staff and no staff groups. Continuous variables are presented with means for the staff and no staff groups.

[b] p-values are from a two-tailed t-test comparing the mean for the no line group to the mean for the line group.

Table 4.2.13
Comparison of Standard Deviations Between the Staff and No Staff Groups Before and After Propensity Weighting for the Model 3 Sample

Variable	No Staff Position SD	Staff Position SD	*p*-value[a]	No Staff Position SD (weighted)	*p*-value[a]
Leadership Positions					
Line	.381	.283	.000**	.284	.871
Aviation	.243	.263	.001**	.263	.999
BCT Cadre	.431	.443	.252	.442	.926
Team Captain	.095	.128	.000**	.127	.737
Demographic Covariates					
Male	.324	.294	.000**	.294	.977
Caucasian	.360	.351	.301	.352	.922
Black	.250	.257	.287	.256	.934
Hispanic	.212	.184	.000**	.185	.767
Asian	.179	.177	.581	.178	.756
Other Race	.073	.074	.385	.075	.640
Northeast	.402	.361	.000**	.361	.982
Midwest	.427	.438	.281	.437	.920
South	.448	.460	.262	.461	.977
West	.436	.435	.965	.435	.986
Other Region	.156	.174	.000**	.173	.720
Year Group 83-84	.476	.465	.360	.465	.963
Year Group 85-86	.465	.482	.124	.482	.967
Year Group 87-88	.473	.465	.498	.465	.982
Rated	.493	.492	.917	.492	.997
Nonrated Ops	.281	.277	.540	.277	.908
Mission Support	.470	.468	.873	.468	.974
Entry Age	.815	.791	.220	.800	.650
Prior ADR	.176	.179	.482	.179	.961
Prep School	.354	.350	.624	.350	.986
Acad Sib	.303	.313	.213	.313	.945

Table 4.2.13-Continued

Variable	No Staff Position SD	Staff Position SD	*p*-value[a]	No Staff Position SD (weighted)	*p*-value[a]
Acad Par	.128	.117	.000**	.117	.836
Mil Par	.426	.432	.585	.433	.887
Application Covariates					
ACT/SAT Concor	101.0	109.4	.001**	101.8	.002**
PAR	88.8	89.4	.774	89.9	.835
Lead Comp	167.7	167.0	.869	167.0	.994
CFA	81.2	82.8	.401	82.0	.677
Sel Panel Rtg	94.0	96.0	.358	94.1	.386
Academy Covariates					
2-YR GPA	.495	.492	.772	.496	.739
2-YR MPA	.277	.266	.088	.272	.392
2-YR AMC	1.263	1.241	.484	1.273	.294

NOTE: The * symbol signifies a statistically significant difference in standard deviations between the individuals in the no staff position group and the staff position group for that variable, *$p<.05$, **$p<.01$. Because the weight applied to the staff group equals 1, the weighted standard deviation for the staff group equals the unweighted standard deviation, so only the weighted values for the no staff group are displayed.

[a] *p*-values are from a two-tailed ratio *f*-test comparing the standard deviation for the no line group to the standard deviation for the line group. One *p*-value is presented for a comparison of the non-weighted standard deviations. Another *p*-value is presented for a comparison of the weighted standard deviations.

Table 4.2.14
Academy Leadership Position Participation as a Predictor of Promotion to at Least Lieutenant Colonel: Propensity Weighted Logistic Regression

Leadership Position Type	Average Marginal Treatment Effect on the Treated
Line (Model 1)	4.6%**
Line (Model 2)	4.6%**
Line (Model 3)	6.5%**
Line (Model 4)	5.2%
Staff (Model 3)	4.4%**

NOTE: **p<.01
These treatment effects come from a logistic regression predicting promotion to at least Lieutenant Colonel with propensity weights applied that were calculated using the predicted probabilities from a regression with the leadership position of interest as the outcome and other positions, demographic covariates, application covariates, and Academy performance covariates as predictors.

Discussion

Having shown evidence for the developmental influence of cadet line positions and a group of staff positions, it is important to investigate *how* the experience of holding one of these positions might be preparing cadets for effective officership. Do these cadet leadership positions provide experiences that are immediately valuable as a junior officer, or are the acquired skills most applicable after reaching higher ranks? As part of this discussion section, I examine the responsibilities assigned to cadets holding line and staff positions and compare these responsibilities to those faced by officers at different rank levels.

I have identified the following six dimensions characterizing cadet leadership positions:

- duration of authority - amount of time the leadership position is held, some positions are held for six weeks, other positions are held for a semester, and some position are held for a year or longer
- organizational structure - the system of authority surrounding the leadership position, some positions exist in hierarchical systems with rank levels resembling the operational Air Force, other positions exist in an environment with a group of peers and one administrator.
- discipline authority – is the leader authorized to disciple subordinates?
- level - tactical, operational, or strategic level responsibilities
- contact with subordinates – low, medium, or high frequency
- contact with superiors – low, medium, or high frequency

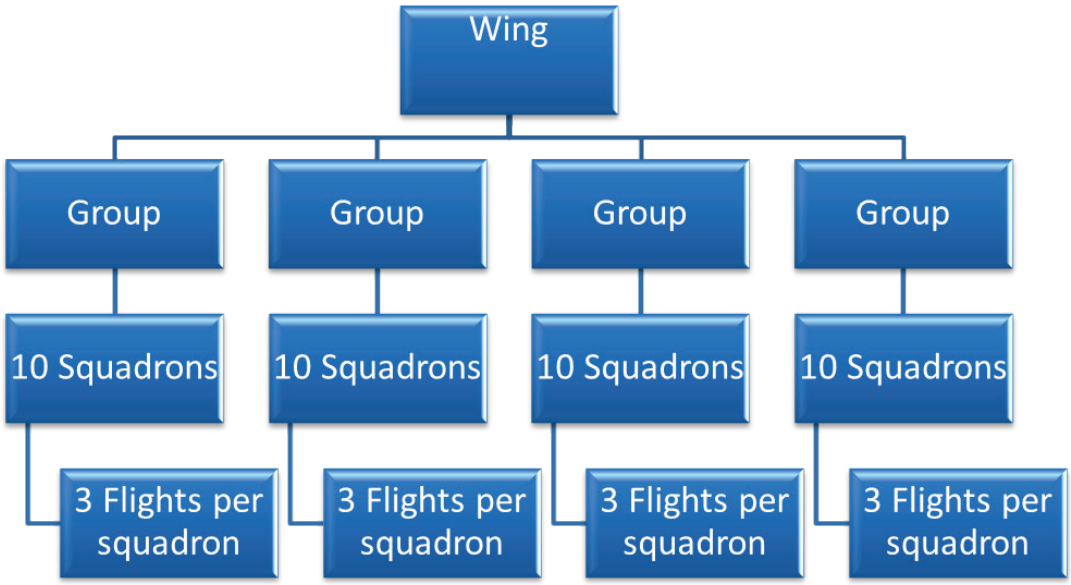
I assess these six dimensions for the line and staff positions, but assessment of these dimensions for the aviation, team captain, and summer positions is limited by less specific descriptions of these positions in the official documents provided by the Academy. As a result, for the aviation, team captain, and summer positions this dissertation highlights a few general notable differences between

positions, but a more comprehensive assessment of these positions on the six dimensions is recommended.

The sections below provide detailed descriptions of the positions that showed a significant relationship with promotion as well as a couple positions that did not show a significant relationship with promotion in the hope of suggesting how the experience of holding line positions or the Model 3 collection of staff positions may prepare cadets for officer responsibilities. Specific assigned tasks for Academy squadron commander, squadron director of operations, squadron chief of training, wing executive officer, and squadron chief of standardization and evaluation positions are listed in Tables 4.2.15-4.2.19 respectively. Columns have been added to the left of the specific tasks indicating if the task requires contact with subordinates, contact with superiors, and/or use of discipline authority.

Line. Cadet line leaders hold authority for one semester at the Academy. The Cadet Wing is organized in a layered hierarchy as depicted in Figure 4.2.1. The layered organizational hierarchy of the Cadet Wing mirrors the operational Air Force structure (AFCWI 38-101, 2008, p. 6; Gurney and Sheehan, 1978, p. 77). Cadets holding line and staff positions are awarded a rank within the Cadet Wing hierarchy commensurate with their position. AFCWI 38-101 (2008, p. 7) asserts that a cadet line leader is "responsible for implementing and enforcing the AFCW Commander's plans, programs and policies and ensures the tactical level execution of daily operations in the Cadet Wing, and is additionally responsible for assigning consequences for poor performance." The responsibility for tactical level execution and discipline are prominent in this description of line responsibilities. Responsibilities involving discipline authority are identified for the squadron commander and squadron director of operation positions in Tables 4.2.15 and 4.2.16 respectively. The squadron commander and squadron director of operations positions both have many responsibilities requiring contact with subordinates and/or superiors.

Figure 4.2.1
Cadet Wing Organizational Structure



Staff. Cadet staff leaders also hold authority for one semester and exercise the responsibilities of their position within the Cadet Wing hierarchy resembling the operational Air Force. According to AFCWI 38-101 (2008, p. 7), a cadet staff leader "provides operational level management of the AFCW Commander's plan, programs and policies and provides inputs and feedback to the line chain of command. The Staff serves as an implementation check and policy guide, advising and providing suggestions to the line chain of command." Staff leaders are described as having an operational level responsibility rather than a tactical level responsibility like line leaders. Discipline authority is not mentioned in the general remark about staff leaders above or in the specific tasks displayed in Tables 4.2.17-4.2.19. The squadron chief of training tasks listed in Table 4.2.17 include a mix of contact with subordinates and contact with superiors. The wing executive officer and squadron chief of standardization and evaluation tasks (listed in Tables 4.2.18 and 4.2.19) primarily reference only contact with superiors.

Next, I explore the general responsibilities associated with officership at different rank levels. Col Donald Waddell (2001, p. 279) details how military officer responsibilities differ with rank:

> Junior officers operate primarily at the tactical level. Their missions are specific: bomb a target, seize and hold terrain, provide support for a specific operation, and so forth. On the other hand, higher levels of leadership have broader missions…As the leader rises above the tactical level, the number of people for whom the leader is responsible increases. Consequently, the interaction with the "troops" becomes less and less direct. For instance, the relatively small number of people in a squadron allows the flight commander and even the squadron commander frequent and direct interaction with his or her people. To discuss an issue, the leader need only use the intercom or walk down the hall to talk to the person who will actually do the work. However, as an officer becomes a group or wing commander or above, he or she inevitably becomes insulated, and communication is now less direct and more through intermediaries.
>
> The leader at the tactical level is primarily a technician, a practitioner, who actually participates in an operation. For instance, at the tactical level a flight commander or squadron commander flies an aircraft, a submarine officer directs the navigation and employment of his weapon system, and a battalion commander leads his men into combat. As leadership is exercised at the higher levels, the technician becomes a generalist who is less concerned about operations at the tactical level and more concerned about the broader application of military power at the strategic levels…Because of the greater number of followers who work for leaders above the tactical level, he or she will have less direct contact with the majority of them. For instance, the officer in charge of a maintenance squadron has 50 to 100 people working for him or her. These subordinates have frequent, direct contact with the leader. As a result, it is relatively easy to communicate values, goals, and guidance. On the other hand, as the midcareer officer today becomes the senior leader of tomorrow, the greater number of subordinates will make frequent, direct contact difficult and eventually impossible…Leadership above the unit level must become less hands on, less technical. The leader must remain firmly in touch with the mission the unit performs, but he or she is now more of a generalist who leaves the details of the operation in the hands of those most familiar with the day-to-day operations.

Junior officers are expected to frequently and directly interact with a small number of subordinates in order to achieve specific tactical objectives. The language from AFCWI 38-101 describing a cadet line leader as being responsible for "ensur[ing] the tactical level execution of daily operations in the Cadet Wing" aligns closely with this description of a junior officer's general responsibilities. Junior officers commanding a section or flight have frequent interaction with their subordinates just as cadet squadron commanders and squadron directors of operations are expected to interact frequently with cadet squadron members. Many of the tasks for cadet squadron commanders and squadron directors of operations in Tables 4.2.15-4.2.16 refer to frequent interactions with subordinates in the form of mentoring, supervising, evaluating, counseling, informing, or delegating. Interacting frequently with subordinates to "ensure the tactical level execution of daily operations" summarizes both the responsibilities of the cadet line leadership positions and the responsibilities of a junior officer.

Line officer responsibilities also include frequent interaction with superiors. Empirical evidence suggests that subordinates and superiors have different expectations of the role a leader should fill in order to be effective (Hooijberg, 2000, p. 361). It is possible that the mix of contact with subordinates and superiors experienced in a cadet line position teaches cadets how to balance the expectations of their subordinates and superiors to accomplish a mission. The requirement for tactical level leadership and frequent interaction with subordinates and superiors shared by cadet line positions and junior officer positions suggests that cadet line leadership positions may prepare cadets for success as junior officers, and this initial success may propel the officer to a series of successes including promotion to Lieutenant Colonel.

Evidence exists that an individual is more likely to emerge as a leader for a task if they have acted as a leader on a similar task in the past (Stogdill, 1974, p. 174). It is possible that the similarities between cadet line position responsibilities and junior officer responsibilities indicate that cadet line leaders are more likely to

emerge in key leadership roles as junior officer. Testing this supposition empirically would further explain the relationship seen between cadet line positions and promotion to at least Lieutenant Colonel.

The squadron chief of training position, which makes up almost 40% of the staff grouping for Model 3 and likely drives the finding of significance for this group, has responsibilities that resemble the line positions more than the staff positions. The squadron chief of training is a unique staff member in that he or she is responsible for leading a larger group of staff and subordinates than a normal staff position and is responsible for implementing tactical training plans on a daily basis like line leaders. Waddell (2001, p. 285) describes how "the interaction between leader and followers is primarily verbal and informal in an operational environment but becomes more formal and written in the staff." The specific assigned tasks for the wing executive officer position are listed in Table 4.2.18. Many of these responsibilities are administrative and do not require frequent interaction with subordinates or execution of a tactical plan like the squadron chief of training position. Though the squadron chief of training position is categorized as a staff position by the Academy, this work suggests it is more similar in responsibility to line positions than other staff positions.

The responsibilities of other cadet leadership positions that did not show a significant relationship with promotion likely differ in some important way from line positions on the dimensions described previously despite the commonality that all positions require some interaction with subordinates. Participation in athletic team captain, aviation, and summer seminar positions does not occur within the formal hierarchy of the Cadet Wing that resembles the operational Air Force.

BCT cadre, AETC cadre, CST cadre, summer seminar, and summer composite group leadership assignments all last for a shorter duration than the line positions. Line positions last for a semester (~20 weeks) while these positions last between 3 and 9 weeks. Staff positions are also held for a semester, while athletic team captain and aviation leadership positions can be held for durations up to two years.

Responsibility for "assigning consequences for poor performance" is a unique responsibility given only to cadet line leaders. While the responsibilities of other leadership positions may broadly imply a discipline function for the leader, line leaders are explicitly directed to "assign consequences for poor performance" by the Commandant of Cadets (AFCWI 38-101, 2008, p. 7).

While I cannot fully describe how the experience of holding a line leadership position or a squadron chief of training position differs from holding other kinds of cadet leadership positions, I do suggest that the tactical level responsibilities and frequent contact with subordinates that characterize cadet line positions and the squadron chief of training position connect closely with the general responsibilities of a junior officer and this connection may explain how these positions influence officer promotion.

Writing in the context of corporate leadership training, Conger (1996, p. 17) argued that an ideal leadership development program should be "designed around different levels of the organization to reflect the leadership issues unique to each level. Upon promotion to another level, a manager would then enter a new cycle of leadership development programs." It appears that the Academy line and squadron chief of training positions are designed to reflect the leadership issues faced at the junior officer level. The fact that these positions showed a relationship with promotion supports Conger's idea that a leadership development program should prepare a person for the immediate responsibilities he or she will face after completing the program. While this dissertation has focused on leadership training prior to being commissioned as an officer, the second part of Conger's argument implies that leadership training must be executed each time a person advances to another level in their organization. This idea suggests that the next step for understanding leadership development of Air Force officers may be an examination of leadership training conducted during an officer's career and whether that training is preparing officers well for their responsibilities in the next level of the organization.

Table 4.2.15
Academy Squadron Commander Specific Assigned Tasks

Contact with Subordinates	Contact with Superiors	Discipline Responsibility	Specific Task[a]
	X		1. Responsible for implementation of the Officer Development System (ODS) at the squadron level. Must make and coordinate a plan with their AOC to accomplish this task.
			2. Executes Cadet Group Commander's Plans, Programs, and Policies.
			3. Establishes squadron goals, processes, policies, and mechanisms to achieve success.
X			4. Employs cadet chain of command to execute AFCW plans for major military training events, developmental programs, and unit activities, and to develop unit esprit-de-corps.
	X		5. Works with cadet and permanent party leadership to improve the morale and welfare of the Cadet Squadron through programs and policies.
X		X	6. Maintains accountability for subordinate commanders and staff execution of directed actions.
		X	7. Maintains good order and discipline establishing squadron disciplinary environment and uniformity of discipline.
		X	8. Ensure effective and efficient squadron staff processes for execution of the Cadet Disciplinary system and administrative actions.
X	X	X	9. Works with squadron staff and AOC to develop appropriate rehabilitative plans for individual cadets. Directs immediate actions to address issues as necessary.
			10. Supervises/Mentors/Evaluates cadet squadron staff and squadron members.
X			11. Develops subordinates' ability to train, mentor, counsel, and evaluate their subordinates through the Leadership Growth Models professional leader-follower behaviors.
X			12. Directly mentors squadron staff in the execution of policies and practices and meeting the challenges of leadership.
			13. Evaluates squadron staff and all squadron members' performance through recommendation of MPAs to the squadron AOC.
X		X	14. Delegate duties as required and hold tasked individuals accountable for completion of duties.
			15. Ensure that the squadron works toward accomplishing set goals, objectives, and mission in all areas: military, athletic, academic, and character development.
X		X	16. Supervise all squadron activities through delegation of authority to squadron staff while requiring feedback to retain knowledge of squadron performance. Hold staff and line officers accountable for their performance.

Table 4.2.15-Continued

Contact with Subordinates	Contact with Superiors	Discipline Responsibility	Specific Task[a]
			26. Ensure the squadron maintains a healthy, neat and orderly living environment.
			17. Ensure squadron compliance with standards outlined in AFCW directives, and AFCW and Commandant policies/guidance.
X			18. Hold staff meetings and Commander's Calls to keep the squadron informed of policies and the state of the squadron.
X			19. Counsel cadets and potential resignees in the Squadron as required.
	X	X	20. Inform Group Commander on the status of the squadron. Coordinate with the Group Commander to provide guidance/input to cadets meeting boards or committees for unsatisfactory performance, behavior, or honor.
			21. Ensure the highest morale, welfare, and safety of the cadets in his/her squadron.
		X	22. Chair all Squadron Commander Review Boards.
X			23. Execute squadron-wide projects (i.e., squadron tailgates, sponsor trips, recognition, Cadet Service Learning, etc). For these projects, the Squadron Commander may select a CIC from the squadron at-large.
X			24. Ensure the successful cadet mentoring/feedback by his line officers and NCOs. Ensure mentoring/feedback is tracked and documented through the element leaders and flight commanders.
X			25. Responsible for ensuring all squadron personnel are properly publicized and promoted for outstanding performance and achievements in awards, organizational announcements, or "Hometown News Releases."

[a] Specific tasks are taken verbatim from Air Force Cadet Wing Instruction 38-101: "Command Duties and Responsibilities."

Table 4.2.16
Academy Squadron Director of Operations Specific Assigned Tasks

Contact with Subordinates	Contact with Superiors	Discipline Responsibility	Specific Task[a]
		X	1. Oversees the squadron's cadet discipline system.
	X	X	2. Monitors and advises the Squadron Commander and AOC on the status of squadron discipline and demerit system.
			3. Prepared to assume command of the squadron in the absence of the Squadron Commander. Understands staff procedures, projects, and drill. Understands line/staff framework.
X			4. Receives input from Stan/Eval to ensure military training addresses weaknesses in squadron performance in military training and standards.
			5. Oversees the athletic, academic and military training functions to enhance squadron performance. Evaluates program effectiveness.
X			6. Conducts staff meetings with Staff and Flight Commanders to ensure cadet performance factors are properly tracked and addressed by the Flight Commanders.
X			7. Manage the Squadron's Duty Officer (SDO) program. Assign first class cadets to fill the SDO duty roster.
X			8. Train all first class cadets on the SDO program.
			9. Oversee the squadron's point system for Outstanding Squadron System.
X	X	X	10. Oversee the squadron discipline system tracking and keeps the Squadron Commander informed. Works directly with the Squadron Superintendent on issues concerning discipline of the lower three classes.

[a] Specific tasks are taken verbatim from Air Force Cadet Wing Instruction 38-101: "Command Duties and Responsibilities.

Table 4.2.17
Academy Squadron Chief of Training Specific Assigned Tasks

Contact with Subordinates	Contact with Superiors	Discipline Responsibility	Specific Task[a]
	X		1. Assist in the development of programs with the Group Director of Training to ensure the Cadet Squadron training is relevant and effective.
X			2. Ensure adequate monitoring and quality control of all cadet training within the squadron and serve as a link between the group and squadron training plans.
	X		3. Monitor, critique, and recommend improvements in CPME, professional development lessons, and cadet military training to the Group Director of Training.
			4. Manage the Cadet Military Education and Training Plan (CMETP) implementation at the squadron level to include conducting and documenting training.
X			5. Ensure all squadron members have an active Advanced Distributed Learning Service (ADLS) account to include a valid Login ID/Password.
			6. Administer the squadron's Air Force Training Records (AFTR) program.
X			7. Ensure all squadron members have an active AFTR account to include a valid login ID/Password.
X			8. Ensure all squadron members are trained on the AFTR trainee roles.
	X		9. Ensure the squadron chain of command understands and complies with CPME policies.
X	X		10. Observe squadron level training and report to the Director of Operations. Ensure that squadron training follows PITO model and is not just directed at training the fourth class cadets.
	X		11. Build and submit bi-weekly squadron training plans to the DO, Sq/CC and the Group Director of Training for approval, and to the Squadron AOC for review and comment to ensure training objectives are clear and relevant. Ensures training is relevant for all class years and is in line with the PITO model. Training plans should include use of MCQ, DDT and Silver Weekend training time.
			12. Work with Stan/Eval to assess the effectiveness of training.
	X		13. Serve as a member of the Wing Training Committee.
X	X		14. Ensure training material is distributed efficiently to appropriate cadets and officers.
X			15. Hold meeting with training staff and Flight Commanders/Element Leaders to gain input on training within the squadron and group.
	X		16. Assist group staff in writing knowledge pro-books and Master Question File for the Cadet Wing's Major Training and evaluation events.

[a] Specific tasks are taken verbatim from Air Force Cadet Wing Instruction 38-101: "Command Duties and Responsibilities."

Table 4.2.18
Academy Wing Executive Officer Specific Assigned Tasks

Contact with Subordinates	Contact with Superiors	Discipline Responsibility	Specific Task[a]
			1. Proofreads all correspondence sent to the Wing Commander for pertinence, accuracy, and suitability.
	X		2. Coordinates appointments and commitments for the Wing Commander with other agencies. Monitors Wing Commander's calendar/agenda, as well as the CW master schedule.
	X		3. Advises the Wing Commander on any coordination problems among staffs and units.
	X		4. Works with the Vice Wing Commander in facilitating communication among staff members concerning current affairs within their duty areas.
			5. Acts as the AFCW adjutant for parades and ceremonies.
	X		6. Acts as liaison with USAFA/CWTSA, Cadet Scheduling Office, for Cadet Escort activities and oversees cadet escorting duties.
			7. Responsible for reserving and coordinating location for meetings between wing staff members and the Cadet Wing.
			8. Disseminates pertinent information to the Cadet Wing from the AFCW/CC.
			9. Ensures accurate management of AFCW information resources, including 100% posting and accountability for all Commandant's Guidance, in accordance with Air Force Enterprise Information Management (AF-EIM) guidelines.
X			10. Supervises the Wing Information Management NCO and is a site administrator on the wing-level organizational SharePoint site.

[a] Specific tasks are taken verbatim from Air Force Cadet Wing Instruction 38-101: "Command Duties and Responsibilities."

Table 4.2.19
Academy Squadron Chief of Stan/Eval Specific Assigned Tasks

Contact with Subordinates	Contact with Superiors	Discipline Responsibility	Specific Task[a]
			1. Be the Squadron's expert in understanding and codifying Stan/Eval policies/guidelines.
	X		2. Conduct periodic inspections of the squadron and suggest areas for improvement and possible methods of improvement to the Squadron Commander.
	X		3. Coordinate with Group and Wing Stan/Eval staff to support evaluation and inspection teams.
			4. Ensure that AFCWIs are adhered to in the squadron.
			5. Develop a program to help the squadron prepare for regular Stan/Eval inspections and SAMIs.
	X		6. Advise the Squadron Commander on indicators/trends of squadron performance. Track trends of squadron performance.
	X		7. Inspect other squadrons at the direction of the Group Stan/Eval staff.
			8. Periodically evaluate the following areas of the squadron and send a report to the Group/Stan/Eval Officer.
			9. Provide Evaluator training to the assistant flight commanders to use as augmentee evaluators. Provide feedback to the Flight Commanders on their contributions to Stan/Eval Staff.

[a] The wording and numbering of the material in the "Specific Task" column is taken verbatim from Air Force Cadet Wing Instruction 38-101: "Command Duties and Responsibilities," but the three columns to the left of the "Specific Task" column are additions by the author.

RESEARCH QUESTION 3:

How does the effect on promotion of holding an Academy line leadership position differ depending on Academy performance, application scores, and demographic information?

Summary of Findings

- The average marginal effect of holding a cadet line position on promotion was:
  - Not significantly negative for any of the subgroups examined
  - Highest for cadets in the lowest quartiles of 2-YR MPA, 2-YR GPA, and PAR
  - Highest for cadets with an AMC of 0
  - Significantly greater than zero for the second and third quartiles of ACT/SAT concordance score and leadership composite
  - Higher for black cadets than for Caucasian cadets
  - Not significantly greater than zero for females
  - Significantly higher for individuals entering the Academy at age seventeen than at age twenty

Introduction

Having shown that a positive relationship exists between holding a line position and promotion to at least Lieutenant Colonel on average for individuals graduating in class years 1983-95, I now proceed to an investigation of how this relationship differs for individuals based on other characteristics. The policy question this research question informs is how the Academy should select individuals for leadership training positions. For example, if cadets with lower military performance scores benefit more from leadership training than those with higher military performance scores, the Academy may want to consider this information in the selection process for leadership positions.

Data Used

The sample includes U.S. Air Force Academy graduates for class years 1983-1995 commissioned into the U.S Air Force whose first primary AFSC places them in the line competitive promotion category. The data are divided into subgroups based on the values of covariates of interest such as 2-YR MPA, 2-YR GPA, ACT/SAT concordance score, leadership composite, race, and gender. For variables that were provided in a continuous form by the Academy, the sample is divided into quartiles where quartile 1 corresponds to the lowest group of scores.[17] For example, cadets are placed into 1 of 4 quartiles based on their 2-YR MPA with quartile 1 containing cadets with the lowest 2-YR MPAs and quartile 4 containing cadets with the highest 2-YR MPAs. For categorical variables I define the subgroups according to the discrete values of the variable.

Methods Used

I perform logistic regressions on subgroups of the sample. This methodology allows for comparison of the line position effects on promotion between individuals holding a line position and individuals not holding a line position within the same subgroup. A separate logistic regression is performed for each subgroup to get the average effect of holding a line position on promotion for that subgroup. An example of a subgroup model using the group with a 2-YR MPA in the first quartile is presented below:

$$logit\,[\,P(LTC = 1|X)\,] = \beta_0 + \beta_{Line}X_{Line} + \beta_k X_k + \varepsilon\,[if\ MPA\ Quartile = 1]$$

[17] I first specified interaction models with the continuous versions of the covariates. A lack of significant findings from these models and a hypothesis that non-linear interaction effects might exist led me to the strategy of dividing the variables into quartiles. With the variables divided into quartiles, I can roughly detect some non-linear interaction effects that I otherwise would not have uncovered from the models using the continuous versions of the covariates. Score ranges for constructing the quartiles are listed in Table 4.3.3 Results from the interaction models using continuous versions of the covariates are presented in Appendix F.

The vector of **k** covariates in the subgroup models is identical to the vector used for Research Question 2 (listed in Table 4.2.6) with the exception that leadership position types other than the line position type are treated as covariates in the subgroup models in this section. I do not analyze the coefficients on the other position types because they did not show a significant relationship with promotion in the prior section.

In the above model, β_{Line} is the term of interest. This term is interpreted as the marginal effect of participating in a line leadership position on promotion to LTC for individuals with a 2-YR MPA score in quartile 1. Maximum likelihood estimates for the coefficients for the line position indicator from all of the subgroup models are listed in Table 4.3.1. The *p*-values listed in this table are for a comparison of the line effect to zero.

I also want to make statistical comparisons between subgroup coefficients. For example, I want to compare β_{Line} for individuals with a 2-YR MPA in quartile 1 to β_{Line} for individuals with a 2-YR MPA in quartile 2. In order to generate *p*-values for these comparisons, I employ models with interaction terms. Interaction terms are created by multiplying the covariates with the line position indicator. The coefficients from these interaction models are highly similar to the coefficients from the subgroup models, so I only display the *p*-values from these models since they inform between group comparisons. The formal specification and exact coefficients for the interaction models are presented in Appendix F.

Results

The first section of Table 4.3.1 contains subgroup results for Academy performance covariates, the next section contains subgroup results for application covariates, and the final section contains subgroup results for demographic covariates.

Table 4.3.2 displays *p*-values for all of the possible paired comparisons between group coefficients. For example, if you are interested in knowing if the coefficient for line position for a person with a 2-YR MPA in the second quartile is different from the

coefficient for line position for a person with a 2-YR MPA in the third quartile you can see the *p*-value from a two-tailed *z*-test in the cell where the "3rd Q" row meets the "2nd Q" column under the "2-YR MPA Int with Line" heading.

Academy Performance Covariate Subgroups. The first subgroup results displayed in Table 4.3.1 show average marginal effects of line position on promotion for the four quartiles of 2-YR MPA. The average marginal effect of holding a line position on promotion to at least the rank of Lieutenant Colonel was positive and significant for each of the four groups. The largest average marginal effect among the four groups existed for cadets with a 2-YR MPA in the first quartile, while the smallest average marginal effect existed for cadets with a 2-YR MPA in the fourth quartile. Cadets with a 2-YR MPA score in the first quartile who held a line position while at the Academy were 15.8 percentage points more likely to be promoted than cadets with a 2-YR MPA score in the first quartile who did not hold a line position. Cadets with a 2-YR MPA score in the fourth quartile who held a line position while at the Academy were 4.2 percentage points more likely to be promoted than cadets with a 2-YR MPA score in the fourth quartile who did not hold a line position. The average marginal effect of holding a line position on promotion was significantly less for quartiles 2, 3, and 4 of MPA than for quartile 1.

Presented next in Table 4.3.1 are the average marginal effects of line position on promotion for the four quartiles of 2-YR GPA. The average marginal effect of holding a line position on promotion was positive and significant for cadets with a 2-YR GPA in the first or fourth quartile. The largest average marginal effect among the four groups existed for cadets with a 2-YR GPA in the first quartile. Cadets with a 2-YR GPA score in the first quartile who held a line position while at the Academy were 10.3 percentage points more likely to be promoted than cadets with a 2-YR GPA score in the first quartile who did not hold a line position. The average marginal effect of holding a line position on promotion was significantly less for quartiles 2, 3, and 4 of GPA than for quartile 1.

The third set of results under “Academy Performance Covariates” in Table 4.3.1 displays average marginal effects of line position on promotion for five subgroups created based on the number of times a cadet was on the athletic merit list in their first two years. The average marginal effects of holding a line position on promotion for cadets on the athletic merit list 0, 1, or 2 times in their first two years were significantly greater than zero. The average marginal effect of holding a line position on promotion was significantly less for cadets on the athletic merit list four times in their first two years than for cadets on the athletic merit list zero times in their first two years.

Application Covariate Subgroups. The subgroups presented in the next section of Table 4.3.1 were created based on score differences on the application to the Academy. The first set of results under “Application Covariates” displays average marginal effects of holding a line position on promotion for the four quartiles of ACT/SAT concordance score. The average marginal effects of holding a line position on promotion for the second and third quartiles of ACT/SAT concordance score were significantly greater than zero. The average marginal effect of holding a line position on promotion was significantly greater for quartile 2 of ACT/SAT concordance score than for quartile 1.

Next, the average marginal effects of line position on promotion for the four quartiles of leadership composite score are displayed. The pattern of effects for the leadership composite quartiles resembled the pattern seen in ACT/SAT concordance quartiles. The average marginal effects of holding a line position on promotion for the second and third quartiles of leadership composite score were significantly greater than zero.

Average marginal effects for prior academic record quartiles are listed next. The average marginal effect of holding a line position on promotion for the first quartile was significantly greater than zero. Cadets with a prior academic record score in the first quartile who held a line position while at the Academy were 8.9 percentage points more likely to be promoted than cadets with a prior academic record

score in the first quartile who did not hold a line position. The average marginal effect of holding a line position on promotion was significantly less for quartiles 2, 3, and 4 of PAR than for quartile 1.

Demographic Covariate Subgroups. The final section of Table 4.3.1 presents subgroups based on demographic information such as gender, age, race, and family military affiliation. It should be noted that the small size of some groups limits the opportunity for a statistically significant effect. The age section of Table 4.3.1 displays average marginal effects of line position on promotion for all possible age values at entry. The ">20" group includes only ages twenty one and twenty two because the age of entry for the Academy is capped by law at 22.[18] The average marginal effect of holding a line position on promotion for individuals entering the Academy at age seventeen was significantly greater than zero. Cadets entering the Academy at age seventeen who held a line position while at the Academy were 8.5 percentage points more likely to be promoted than cadets entering the Academy at age seventeen who did not hold a line position. The average marginal effect of holding a line position on promotion was significantly less for individuals entering the Academy at age twenty than at age seventeen.

The average marginal effect of holding a line position was significantly greater than zero for males but not for females. Males holding a line position were 5.6 percentage points more likely to be promoted than males who did not hold a line position.

With a *p*-value of .053, the average marginal effect of holding a line position on promotion for black cadets was greater than for Caucasian cadets at a marginal significance level. Only 101 black cadets in the sample held a line position. The significance of this finding might increase with the greater power to detect an effect that comes with a greater sample size.

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[18] See Title 10, Subtitle D, Part III, Chapter 903, Section 9346 of the U.S. Code.

Table 4.3.1
Marginal Effect of Line Position for Subgroups of the Class Years 1983-95 Sample

Subgroups[a]	Cadets in Subgroup	Cadets with a Line Position	Average Marginal Effect of Line Position on Promotion	*p*-value
Academy Performance Covariates				
2-YR MPA	-	-	-	-
1st Quartile (2.08-2.68)	3,065	93	15.8%**	.002
2nd Quartile (2.69-2.86)	3,027	249	7.5%*	.019
3rd Quartile (2.87-3.07)	3,023	490	8.2%**	.001
4th Quartile (3.08-3.85)	3,059	1162	4.2%*	.022
2-YR GPA	-	-	-	-
1st Quartile (1.57-2.43)	3,039	284	10.3%**	.001
2nd Quartile (2.44-2.76)	3,033	425	5.1%	.052
3rd Quartile (2.77-3.15)	3,044	551	4.7%	.056
4th Quartile (3.16-4.00)	3,052	733	4.8%*	.028
2-YR AMC	-	-	-	-
0 AMC	6,329	605	6.5%**	.002
1 AMC	2,498	428	5.5%*	.042
2 AMC	1,593	348	8.6%**	.005
3 AMC	998	301	4.7%	.180
4 AMC	752	310	1.4%	.721
Application Covariates				
ACT/SAT Concordance Score	-	-	-	-
1st Quartile (910-1240)	3,141	456	4.1%	.106
2nd Quartile (1250-1300)	3,217	552	8.2%**	.001
3rd Quartile (1310-1380)	3,523	588	6.0%*	.010
4th Quartile (1390-1600)	2,293	398	3.8%	.180

Table 4.3.1-Continued

Subgroups[a]	Cadets in Subgroup	Cadets with a Line Position	Average Marginal Effect of Line Position on Promotion	*p*-value
Leadership Composite Score	-	-	-	-
1st Quartile (1100-1550)	3,201	422	4.9%	.061
2nd Quartile (1551-1670)	2,999	450	7.2%**	.006
3rd Quartile (1671-1800)	3,047	518	7.4%**	.003
4th Quartile (1801-2400)	2,927	604	2.9%	.209
Prior Academic Record Score	-	-	-	-
1st Quartile (350-575)	3,085	383	8.9%**	.001
2nd Quartile (576-632)	3,042	503	2.4%	.331
3rd Quartile (637-702)	3,009	497	7.3%**	.004
4th Quartile (703-804)	3,038	611	4.2%	.076
Demographic Covariates				
Age at Entry	-	-	-	-
17	2,745	430	8.5%**	.002
18	6,940	1152	5.1%**	.002
19	1,895	298	5.9%	.068
20	384	71	-2.9%	.652
> 20	207	42	-1.0%	.898
Gender	-	-	-	-
Female	1,392	149	2.9%	.468
Male	10,782	1845	5.6%**	.000

Table 4.3.1-Continued

Subgroups[a]	Cadets in Subgroup	Cadets with a Line Position	Average Marginal Effect of Line Position on Promotion	*p*-value
Race	-	-	-	-
Caucasian	10,368	1745	5.4%**	.000
Black	795	101	9.8%	.064
Hispanic	558	76	6.7%	.321
Asian	378	59	1.7%	.811

NOTE: *p*-values are for a two-tailed *z*-test comparing the line average marginal effect to zero
*$p<.05$, **$p<.01$

[a] Quartile indicators were created for continuous variables in order to compare well below average, slightly below average, slightly above average, and well above average groups. Quartile 1 corresponds to the lowest group of scores. Results for each line of the table come from a unique model specified only for the subgroup listed. For example, the line effect for cadets with a two-year MPA in the first quartile was calculated by specifying a model with line position as a predictor of promotion to Lieutenant Colonel for only cadets with a two-year MPA score in the first quartile. The same set of covariates that was included in the four models in the research question 2 section were also included, but their coefficients are omitted from the table for simplicity.

Table 4.3.2
***p*-values Comparing Coefficients Between Groups**

Variable		1st Q	2nd Q	3rd Q	
2- YR MPA	1st Q	-	-	-	
	2nd Q	.000**	-	-	
	3rd Q	.000**	.296	-	
	4th Q	.000**	.064	.004**	
2-YR GPA	1st Q	-	-	-	
	2nd Q	.002**	-	-	
	3rd Q	.000**	.425	-	
	4th Q	.001**	.760	.635	
ACT/SAT Con	1st Q	-	-	-	
	2nd Q	.012*	-	-	
	3rd Q	.156	.229	-	
	4th Q	.492	.055	.453	
PAR	1st Q	-	-	-	
	2nd Q	.000**	-	-	
	3rd Q	.015*	.111	-	
	4th Q	.001**	.573	.299	
Lead Comp	1st Q	-	-	-	
	2nd Q	.197	-	-	
	3rd Q	.009**	.165	-	
	4th Q	.297	.017*	.000**	
		0	1	2	3
2-YR AMC	0	-	-	-	-
	1	.108	-	-	-
	2	.986	.140	-	-
	3	.097	.994	.119	-
	4	.000**	.031*	.000**	.087
		17	18	19	20
Age Entry	17	-	-	-	-
	18	.129	-	-	-
	19	.121	.995	-	-
	20	.000**	.000**	.000**	-
	>20	.667	.208	.229	.008**

Table 4.3.2-Continued

Variable		C	B	H
Race	Caucasian	-	-	-
	Black	.053	-	-
	Hispanic	.049*[a]	.002**	-
	Asian	.573	.044*	.306
		Female		
Gender	Male	.082		

NOTE: *p*-values are for a two-tailed *z*-test, *p<.05, **p<.01
These p-values come from models specified using interaction terms between the line position indicator and the variables in the left column. The coefficients from these models are only slightly different than the coefficients from the subgroup model results in Table 4.3.1. The coefficients and main effects from these interaction models are displayed in full in Appendix F.

[a] This *p*-value indicates the effect on promotion of holding a line position is significantly smaller for Hispanics (.9%) than for Caucasians (5.3%). For a discussion of why the effect on promotion of holding a line position is significantly smaller for Hispanics than for Caucasians in this model while the coefficient is larger for Hispanics than for Caucasians in the model presented in the previous table (Table 4.3.1) see note C in Table F.1.

Discussion

The findings in Table 4.3.1 show the average marginal effects for a host of subgroups. The average marginal effect was only negative for three subgroups, and none of those effects were statistically significant. This finding suggests the broad effectiveness of the line leadership positions. Other researchers have found that some types of leadership training are dysfunctional for some types of people (Fiedler, 1972, p. 453). For this dissertation's sample, it did not appear to be the case that cadet line leadership positions hindered some individuals and helped other individuals. It appeared that the positions were beneficial for all types of individuals but in differing degrees.

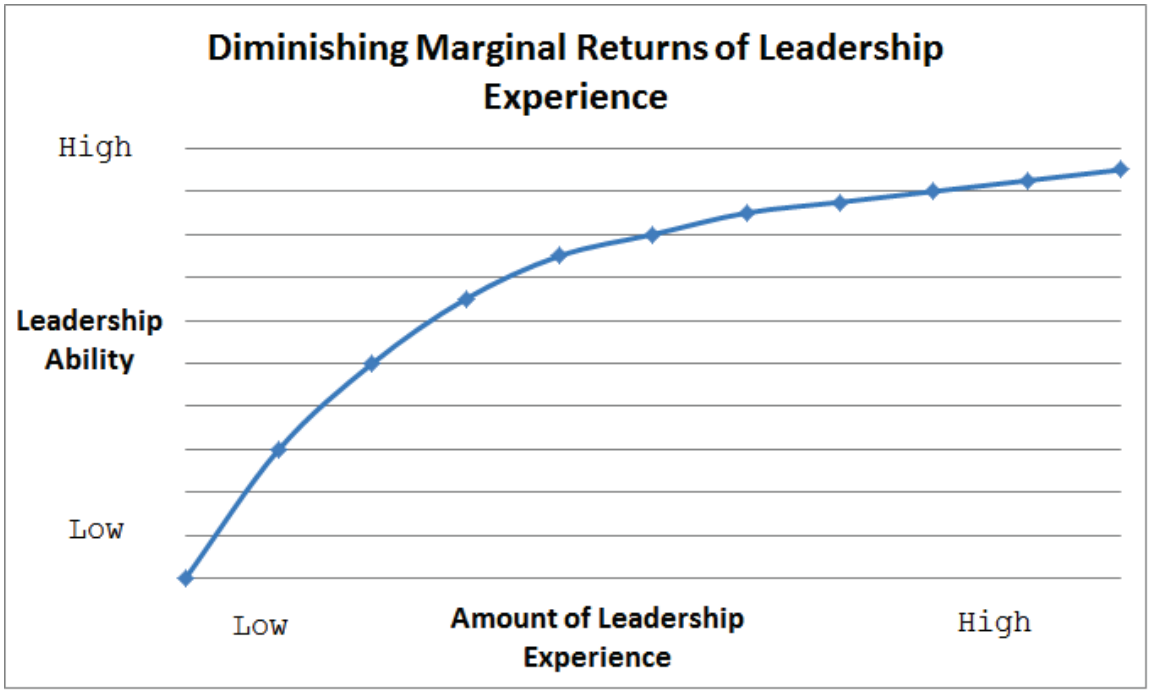
Line positions had the largest marginal effect on promotion for individuals with a 2-YR MPA in the lowest quartile. This finding suggests that line leadership positions might be a particularly beneficial training mechanism for individuals who demonstrate below average leadership skills, since the military performance average is partially determined by demonstration of leadership. DeRue and Wellman (2009, p. 859) found diminishing returns in the relationship between intensity of a developmental challenge and leadership skill development. While Derue and Wellman focused on diminishing returns related to intensity of training, I suspect my finding relates to diminishing returns in terms of amount of leadership experience.[19]

Figure 4.3.1 provides an illustration of how the theory of diminishing returns might apply to amount of leadership experience. Leadership ability was described in the first chapter as a combination of innate capabilities and experience. If I assume that leadership experience can be quantified in a numeric amount and that leadership ability can be quantified on a scale of 1 to 10, I can plot a notional chart describing how leadership ability might change as leadership experience changes according to the theory of diminishing marginal

[19] See Nicholson & Snyder, 2008, p. 296, for a basic explanation of diminishing returns.

returns. The decreasing slope of the curve in Figure 4.3.1 indicates that the increase in leadership ability for a unit of leadership experience decreases for each additional unit of leadership experience. To the extent that 2-YR MPA is a measure of past leadership experience and promotion is a measure of leadership ability I can explain my finding with this theory. If cadets with a 2-YR MPA in the lowest quartile roughly have the least amount of leadership experience in the sample, the marginal effect on promotion probability of participating in a line leadership position may be larger for this group than for the other four quartiles because the return on participation from a leadership position may decrease with the more leadership experience held by the participant.

Figure 4.3.1 Diminishing Marginal Returns of Leadership Experience (Notional)



The same pattern of the lowest performers having the largest marginal effect held for 2-YR GPA and 2-YR AMC, though the implications of these findings are less clear. It is possible that holding a line

leadership position improved the sense of efficacy for individuals with low 2-YR GPA 2-YR AMC such that the individuals become more empowered to pursue career success as a result of being selected for a position of importance within the cadet wing. In its conceptual framework for developing leaders of character, the Academy stated "self-efficacy is derived from the ability to master experiences and challenges, as well as the ability to receive constructive feedback and encouragement about one's perceived capacities" (Center for Character and Leadership Development, 2011, p. 6). I suggest that being selected for a line leadership position acts as "encouragement about one's perceived capacities" and thus serves to improve self-efficacy. Ely and Rhode (2010, p. 379) argued that being able to establish a self-identity as a leader is important for leader development. Swann, Chang-Schneider, and McClarty (2007, p. 92) championed a positive self-view as an important predictor of social outcomes. It is possible that selection to a line leadership established a leader identity for cadets with low 2-YR GPA and 2-YR AMC that they otherwise would not have established. It is also possible that 2-YR GPA and 2-YR AMC measure leadership experience in some part, such that the discussion of 2-YR MPA above also applies to these two measures.

Next, I move to a discussion of the findings for how the effect of holding a line position varies according to applicant performance measures. The average marginal effects for quartiles of ACT/SAT concordance score and leadership composite score showed a similar pattern. The second and third quartiles for each of these variables were significantly greater than zero. Northouse (2010, p. 20) asserted a difference in intelligence quotient between leaders and followers can impede communication. It is possible that having an average cognitive ability or average level of pre-Academy leadership experience allowed individuals in the line position to connect with and motivate their subordinates more easily than individuals in either the 1st or 4th who might have struggled to communicate effectively with their subordinates.

The average marginal effect for the first quartile of PAR score was significantly higher than the other three quartiles. The efficacy

argument applied to the 2-YR GPA score above might also apply to PAR score. Individuals with well below average academic performance in high school who were awarded a leadership position may have become more encouraged to apply themselves in pursuit of a successful career as a result of being selected for a prominent position.

Average marginal effects for subgroups created based on demographic information such as age and race offer a few interesting points of discussion. The average marginal effect for individuals entering the Academy at age seventeen was significantly greater than the average marginal effect for individuals entering at age twenty as shown by the results in the age section of Table 4.3.2. This finding might be explained by considering age a partial measure of leadership experience that captures some information missed by the leadership composite and 2-YR MPA measures. If this speculation is true, the diminishing marginal return theory of leadership experience could explain how a seventeen year old gets a greater marginal effect out of having a leadership position than a twenty year old. On average, a cadet who entered the Academy at age seventeen may have fewer experiences related to leadership that are not accounted for by other measures than a cadet who entered the Academy at age twenty, and thus improves in leadership ability by a greater amount from the line position experience. Another possible explanation of this finding comes from the results of a meta-analysis on training motivation. Colquitt, Lepine, and Noe (2000, p. 700) found age to be negatively related to motivation to learn and ability to learn. Though the age differences among cadets are small, Colquitt, Lepine, and Noe's research may partly explain my finding.

The finding that holding a line position did not show a significant association with promotion for females may be cause for concern. Eagly, Karau, and Makhijani (1995, p. 125) presented meta-analytic results showing men to be more effective than women in roles with masculine descriptions and in roles with a high proportion of male subordinates. The authors noted that "the role of military officer (and cadet) has been defined in exceedingly masculine terms" and assessments of leader effectiveness may be affected by raters' gender role

expectations (Eagly, Karau, and Makhijani, 1995, p. 138). Kawakami, White, and Langer (2000, p. 50) argued "The gender stereotype of women as warm, nurturing, and caring and the corresponding stereotype of men as cold, competitive, and authoritarian may have contributed to a popular perception that women are less effective than men in leadership positions." Perceptions that cadet leadership positions are masculine and the fact that a higher proportion of subordinates at the Academy are male may present barriers to development for female cadets holding line leadership positions.

This dissertation found that a larger average marginal effect on promotion exists for black cadets holding a line position than for Caucasian cadets holding a line position after accounting for covariates such as GPA. The models in the question 2 section consistently showed a strong negative association between being black and promotion. The finding in this section suggests that the experience of holding a line leadership position is very developmental for black cadets. Bartol, Evans, and Stith (1978, p. 301) argued that "the ethnic identifications of the leader, the leader's supervisor and the subordinates are important variables" when examining leadership situations. It is possible the experience of a cadet line position allows a black cadet to become more adept at navigating the complexities of leading in an environment with a large majority group and several small minority groups. The experience of holding a line position may prepare black cadets for leading as officers in the Air Force where the majority group makes up over 70% of the total force and no minority group makes up more than 15% of the total force (Air Force Personnel Center).

The Air Force uses a "whole-person" evaluation concept in promotion boards (Grill, 2011). The Air Force may intend this phrase to convey the idea that many pieces of information about an individual are considered in the promotion decision, but Guion (2011, p. 21) suggested the whole-person view should be about more than assessing people on a bundle of traits. According to Guion's interpretation, a whole-person selection process requires evaluating each piece of selection information in the context of the other known information about the

applicant. For example, academic achievement may be considered less important if it is known that the applicant attended a high school with a poor teaching staff. If the Academy intends to apply a "whole-person" evaluation concept to selecting cadet leaders, understanding applicants' motivation to lead and commitment to learning may be important information to include in the selection decision.

Chan and Drasgow (2001, p. 496) showed a positive association between a measure of motivation to lead and two measures of leadership potential. Lohmann (2001, p. 139) contended that leadership development requires a conscious commitment, on behalf of the leader, to learning from experience. McCall (2010, p. 705) advised leadership development program administrators that it is imperative to use leadership experience opportunities wisely to help individuals who are motivated to lead and committed to learning. Avolio and Hannah (2008, p. 336) argued that assessing an individual's motivation to learn about leadership is critical for understanding their readiness for a developmental opportunity. I suspect the cadets selected for line positions who were below average performers on Academy performance scores such as 2-YR MPA, 2-YR GPA, and 2-YR AMC demonstrated a high level of motivation to hold a line position and learn from experience and were selected in part because of that demonstrated motivation. It is possible that an expressed motivation to lead and learn by a cadet who has struggled to emerge as a leader previously may signal the cadet is primed to improve his or her leadership skills substantially by participating in a line leadership position.

I recommend formally assessing the motivation of individuals applying for line leadership positions and considering that motivation information in the context of other performance information. If motivation information is not formally assessed in the selection process, some cadets who are highly motivated but poor performers on other metrics may be rejected strictly because their performance scores are low. The results in this section suggest that important development opportunities may be lost by denying these individuals a line leadership position.

McCall (2010, p. 688) presented competing perspectives concerning to whom leadership experience opportunities should be given: the perspective that leadership development experiences should be given to individuals who will learn the most from the experiences, and the perspective that leadership development experiences should be awarded based on a past record of high performance. Creating selection rules that reward past performance and provide opportunities for those who will learn the most requires finesse. Assessing past performance and how much individuals will learn is the first step for a development program selection process. If you do not have information about performance or how much individuals will learn, you cannot incorporate it into the selection decision. I recommend that part of understanding how much individuals will learn is measuring motivation to learn. Next, administrators must decide how to weight past performance and predicted learning gains in order to satisfy organizational objectives. For example, if the training program aims to maximize the total leadership ability in the organization, predicted learning gains would receive more weight. If the training program aims to produce a handful of leaders above a certain ability threshold, past performance may deserve more weight.

RESEARCH QUESTION 4:

How does the effect on promotion of holding an Academy leadership position differ by career field assignment at graduation?

Summary of Findings

- Cadets who participated in a line position were significantly more likely to be promoted than cadets who did not participate in a line position for both rated and non-rated career fields
- Cadets who participated in an aviation position were significantly less likely to be promoted than cadets who did not participate in an aviation position for rated career fields

Introduction

Having shown that the effect on promotion of holding an Academy line leadership position differs according to many performance and demographic characteristics, I now examine how the effect of holding a line, aviation, BCT cadre, or athletic team captain position differs by career field assignment at graduation. It is possible that certain Academy leadership positions may prepare cadets for officership in a particular type of career field. For example, cadet aviation positions may prepare cadets for officership responsibilities in an aviation-related career field such as pilot or navigator. If a leadership position prepares cadets for a certain career field type better than other types, the Academy might consider incorporating information about leadership position participation into career field assignment, or may consider suggesting a certain type of leadership position to cadets interested in a particular career field.

Data Used

The sample used to address this question includes individuals who graduated from the Air Force Academy in years 1983-1995 and were commissioned as Air Force officers with a first primary AFSC in the line competitive category. The same set of leadership positions,

demographic covariates, Academy performance covariates, and application covariates used in Model 1 from the research question 2 section are used in this section with the exception that career field group is no longer included as a covariate but instead is used to divide the sample into subgroups. Because the number of cadets who enter the non-rated operations career field group is small, I combine the non-rated operations career field group and mission support career field group into one group labeled non-rated career fields. In summary, for this analysis I divide career fields into two groups: rated career fields and non-rated career fields. An officer's first primary AFSC after graduation was used to place the officer in a career field group.

Methods Used

In order to compare cadets holding leadership positions with cadets not holding leadership positions who enter the same career field group, I perform logistic regressions on two subgroups of the full sample. One regression is specified for only cadets entering a rated career field. Another regression is specified for only cadets entering a non-rated career field. The regression on subgroup methodology allows for comparison between individuals holding a leadership position and individuals not holding a position within the same career field group.

$$logit\,[\,P(LTC = 1|X)\,] = \beta_0 + \beta_{Line}X_{Line} + \beta_{AV}X_{AV} + \beta_{BCT}X_{BCT} + \beta_{TC}X_{TC} + \beta_{\boldsymbol{k}}X_{\boldsymbol{k}} + \varepsilon\,[if\ Rated]$$

$$logit\,[\,P(LTC = 1|X)\,] = \beta_0 + \beta_{Line}X_{Line} + \beta_{AV}X_{AV} + \beta_{BCT}X_{BCT} + \beta_{TC}X_{TC} + \beta_{\boldsymbol{k}}X_{\boldsymbol{k}} + \varepsilon\,[if\ NonRated]$$

Results

Maximum likelihood estimates for the coefficients from the two subgroup logistic regression models are presented as average marginal effects in Table 4.4.1. All results presented refer to promotion to the rank of at least Lieutenant Colonel for class years 1983 to 1995 while controlling for the same set of covariates included in Model 1 from the research question 2 section.

In Table 4.4.1 under the heading "Rated Career Fields," average marginal effects are listed for the line, aviation, BCT cadre, and athletic team captain position types within the rated career field

subgroup. Cadets with a rated first primary AFSC who held a line leadership position were 4.5 percentage points more likely to be promoted than cadets with a rated first primary AFSC who did not hold a line leadership position. Cadets with a rated first primary AFSC who held an aviation leadership position were 4.1 percentage points less likely to be promoted than cadets with a rated first primary AFSC who did not hold an aviation leadership position.

In Table 4.4.1 under the heading “Non-Rated Career Fields,” average marginal effects are listed for the line, aviation, BCT cadre, and athletic team captain position types within the non-rated career field subgroup. Cadets with a non-rated first primary AFSC who held a line leadership position were 5.9 percentage points more likely to be promoted than cadets with a non-rated first primary AFSC who did not hold a line leadership position.

Table 4.4.1
Leadership Position Type Effects on Promotion to LTC by Career Field Group for Class Years 1983-95

Variable	*n*	Average Marginal Effect	*p*-value
Rated Career Fields	5,784	-	-
Line	1,135	4.5%**	.007
Aviation	719	-4.1%*	.043
BCT Cadre	4,182	1.1%	.486
Team Captain	89	4.1%	.432
Non-Rated Career Fields	6,390	-	-
Line	859	5.9%**	.002
Aviation	231	.9%	.782
BCT Cadre	4,966	-1.5%	.316
Team Captain	192	3.8%	.287

NOTE: Results were obtained by performing a logistic regression for each career field group including the same set of covariates used in the four models from section 4.2. The dependent variable for these regressions is promotion to at least the rank of Lieutenant Colonel. *p*-values are for a two-tailed *z*-test testing if the average marginal effect is different from 0, *$p<.05$, **$p<.01$

Discussion

The positive and significant association between holding a cadet line leadership position and promotion was consistent for rated and non-rated career fields despite the fact that job responsibilities and necessary skills differ between rated and non-rated career fields (Conley and Robbert, 2009, p. 11). Line leadership positions appear broadly valuable at preparing cadets for officer responsibilities in either rated or non-rated career fields. This finding adds support to the idea that some leadership skills are applicable to a wide variety of challenges (Mumford et al., 2000, pp. 16-18).

The association between holding a cadet aviation leadership position and promotion for the rated career field group occurs in the opposite direction of what I expected. I anticipated a positive association between holding a cadet aviation position and promotion for the rated group. I expected that holding a cadet leadership position in an environment with an aviation-related mission would be associated with a higher likelihood for promotion in career fields related to aviation (see Gurney and Sheehan, 1978, p. 83).

In studying stock marker forecasters, Deaves, Luders, and Schroder (2010, p. 403) showed that more market experience is associated with higher levels of overconfidence. Argyris (1991, p. 1) described how those who are assumed to be the best learners because they have a history of success are often the worst learners because they have experienced little failure and become defensive in the face of criticism. This learning paradox may partly explain my finding. Cadets who participate in cadet aviation leadership positions may feel highly confident about their abilities as a result of their experience. When they enter their first training assignment as an officer, they may react negatively to criticism from their instructors and consequently learn less and perform more poorly than their peers.

RESEARCH QUESTION 5:

Which Academy admissions and demographic variables show significant associations with participation in a cadet line leadership position?

Summary of Findings

- Most of the admission measures aimed at evaluating leadership showed a significant and positive association with participation in a cadet line position
- Being a recruited athlete showed a negative association with participation in a line leadership position
- Females were less likely than males to hold a line leadership position
- Hispanics and Asians were less likely than Caucasians to hold a line leadership position
- Prep school attendees and cadets without a close family military connection to the military were less likely to hold a line leadership position
- Cadets with prior active duty regular service were more likely to hold a line leadership position
- A model with ALO sub-scores had a significantly greater ability to predict participation in a line position than a model with the final ALO score

Introduction

If the Academy expects applicants who score highly on the leadership-related admission variables to advance to prestigious leadership roles in the Academy, I expect to see a predictive relationship between leadership-related admission variables and participation in a cadet line position. If this predictive relationship does not exist, it may indicate the admission criteria are not functioning as they are intended and should be reconsidered.

Detecting significant group differences in participation rates is also of interest in this question. Since we have shown participation in a cadet line position to be significantly related to promotion, care

must be taken in the distribution of these positions to ensure no group's promotion chances are negatively impacted by low line position participation rates.

Data Used

A summary of the variables used in this section that have not been described previously is included as Table 4.5.1. The sample of data used to address this research question includes cadets who entered the Academy in class years 1982-2011. Many of the admission data elements examined are only available for a smaller portion of this sample. Table 4.5.2 clarifies the class years for which each variable is available in the sample. Table 4.5.3 presents means and standard deviations for continuous admission variables used in this section over the years available for each variable.

It should be noted that I assume the selection process and responsibilities of line positions for class years 1996-2011 resemble those of class years 1983-1995. If the selection process or responsibilities were substantially altered during the 1996-2011 timeframe, the relationships demonstrated in the previous sections may not hold. In that case, evaluating admission variables by examining their predictive relationship with holding a line position is less useful. I do not have any evidence indicating the selection process or responsibilities of line positions changed substantially for class years 1996-2011 compared to class years 1983-1995.

Methods Used

Means and standard deviations are calculated to provide descriptive information about continuous admission variables. Raw correlations are calculated between admission variables and participation in a line position. Raw correlations are also calculated between demographic variables and participation in a line position. It should be noted that the magnitudes of some correlations are limited by the distribution of the admission variable or demographic variable and all correlations are limited in magnitude by the binomial distribution of the line position indicator variable. Therefore, correlation

magnitudes should be interpreted according to the distributions of the two variables compared (Davenport Jr. and El-Sanhurry, 1991, p. 821).

I perform bivariate logistic regressions for each of the admission variables on the class years where data were available for that variable. For each X_i in the $X_1 \dots X_N$ set of admission and demographic variables listed in column 1 of Table 4.5.4, a unique bivariate regression of the following form is specified:

$$logit[P(Line = 1|X_i)] = \beta_0 + \beta_i X_i + \varepsilon$$

Four multivariate logistic regressions are also specified using four different collections of variables predicting participation in a line position. I model composite scores and their component scores separately. For example, the leadership composite score includes the athletic activity score and the non-athletic activity score as components. Model A includes the leadership composite score, while Model B includes the athletic activity score and non-athletic activity score. Different samples of class years are used in the models to enable comparisons of interest based on the available data. For example, Models A and B do not include ALO ratings because those ratings were only available for class years 1994-1998, 2000, and 2005-2011. The specification for Model A is listed below:

$$\begin{aligned} &logit[P(Line = 1|X)] \\ &\quad = \beta_0 + \beta_{LeadComp}X_{LeadComp} + \beta_{AcaComp}X_{AcaComp} + \beta_{SelPanelRtg}X_{SelPanelRtg} \\ &\quad + \beta_{Gender}X_{Gender} + \beta_{Race}X_{Race} + \beta_{Region}X_{Region} + \beta_{Age}X_{Age} + \beta_{Recruit}X_{Recruit} + \varepsilon \end{aligned}$$

Table 4.5.1
Summary of Variables Used In This Section That Have Not Been Described Previously

Variable	Abbreviation	Data Type[a]	Description
Application Covariates			
Selection Composite	Sel Cmp	C	This variable is a meta-composite score calculated by the Academy Admissions Department by combining the academic, leadership, and weighted composites.
Academic Composite	Aca Cmp	C	This variable is a composite score calculated by the Academy Admissions Department by combining information about high school grade point average, strength of curriculum, SAT/ACT scores, and class rank.
ACT/SAT Verb Concordance Score	ACT/SAT Verb	C	This variable indicates the highest ACT or SAT verbal score submitted by an individual when applying to the Academy. Scores are placed on the same scale using concordance tables published by the College Board.
ACT/SAT Math Concordance Score	ACT/SAT Math	C	This variable indicates the highest ACT or SAT math score submitted by an individual when applying to the Academy. Scores are placed on the same scale using concordance tables published by the College Board.
Athletic Activity Score	AAS	C	This variable is a composite score calculated by the Academy Admissions Department combining information about high school athletic leadership activities.
Non-Athletic Activity Score	NAAS	C	This variable is a composite score calculated by the Academy Admissions Department combining information about high school leadership activities that are not related to athletics.
Academy Liaison Officer Final Rating	ALO Final Rtg	C	This variable is an additive combination of all the scores assigned to a candidate by their Academy Liaison Officer.
Academy Liaison Officer Recommendation	ALO Rec	C	This five values of this variable represent an ALO's overall evaluation of a candidate on a scale ranging from 1 being "not recommended" to 5 being "exceptional applicant."
Academy Liaison Officer Self Confidence Rating	ALO SC	C	This five category variable reflects an ALO's assessment of a candidate's self confidence (1=Low, 5=High).
Academy Liaison Officer Human Relations Rating	ALO HR	C	This five values of this variable reflect an ALO's assessment of a candidate's ability to relate with others (1=Low, 5=High).
Academy Liaison Officer Planning Rating	ALO PL	C	This five values of this variable reflect an ALO's assessment of a candidate's planning and organization skills (1=Low, 5=High).
Academy Liaison Officer Communicative Skills Rating	ALO CS	C	This five values of this variable reflect an ALO's assessment of a candidate's communicative skills (1=Low, 5=High).
Academy Liaison Officer Leadership Rating	ALO Lead	C	This five values of this variable reflect an ALO's assessment of a candidate's leadership skills (1=Low, 5=High).
Academy Liaison Officer Motivation Rating	ALO Mot	C	This five values of this variable reflect an ALO's assessment of a candidate's motivation toward service as an officer in the Air Force (1=Low, 5=High)
Academy Liaison Officer Preparation Rating	ALO Prep	C	This five values of this variable reflect an ALO's assessment of a candidate's preparation for military service (1=Low, 5=High)

Table 4.5.1-Continued

Variable	Abbreviation	Data Type[a]	Description
All-State Count	AS Count	C	This variable represents the number of times an individual was an all state athlete in high school.
Team Captain Count	TC Count	C	This variable represents the number of times an individual was an athletic team captain in high school.
Varsity Count	Var Count	C	This variable represents the number of varsity sports participated in by an individual in high school.
Letter Count	Let Count	C	This variable represents the number of athletic letters earned by an individual in high school.
Community Activity	Comm Acty	D	A value of 1 for this variable indicates an individual participated in a community in high school.
Extra-Curricular Activity	EC Acty	D	A value of 1 for this variable indicates an individual participated in an extra-curricular activity in high school.
Special Recognition	Spec Rec	D	A value of 1 for this variable indicates an individual received special recognition for an achievement in high school.
Student Government	Stud Gov	D	A value of 1 for this variable indicates an individual participated in student government in high school.
Work Experience	Work Exp	D	A value of 1 for this variable indicates an individual worked on school days outside of school in either a paying job or on a farm.
Scout		D	A value of 1 for this variable indicates an individual was participated in either boy or girl scouts.
Class President	Class Pres	D	A value of 1 for this variable indicates an individual held the office of class president in high school.
Honor Society Leader	HSL	D	A value of 1 for this variable indicates an individual was a leader in his or her high school's national honor society chapter.
Honor Society Member	HSM	D	A value of 1 for this variable indicates an individual was a member of his or her high school's national honor society chapter.
Junior Reserve Officer Training Corps	JROTC	D	A value of 1 for this variable indicates an individual participated in the JROTC program at their high school.
Civil Air Patrol	CAP	D	A value of 1 for this variable indicates an individual was a member of a civil air patrol unit at the time of application to the Academy.
Orchestra Leader	Orch Lead	D	A value of 1 for this variable indicates an individual was a leader in his or her high school orchestra.
Orchestra Member	Orch Mem	D	A value of 1 for this variable indicates an individual was a member of his or her high school orchestra.
Band Leader	Band Lead	D	A value of 1 for this variable indicates an individual was a leader in his or her high school band.
Band Member	Band Mem	D	A value of 1 for this variable indicates an individual was a member of his or her high school band.
Prior College	Prior Coll	D	A value of 1 for this variable indicates an individual attended college prior to entering the Academy.
Athletic Recruit	Ath Rec	D	A value of 1 for this variable indicates an individual was recruited for an athletic sport by the Academy.

[a] D=Dichotomous, C=Continuous

Table 4.5.2
Admission Data Availability

Variable	Data Available for Class Years
Leadership Composite	1982-2011
Academic Composite	1982-2011
Selection Composite	1982-2011
ACT SAT Concordance	1982-2011
ACT SAT Verb Concordance	1982-2011
ACT SAT Math Concordance	1982-2011
Athletic Activity Score	1982-2011
Non-Athletic Activity Score	1982-2011
ALO Final Rating	1994-98, 2000, 2005-11
ALO Recommendation	1994-98, 2000, 2005-11
ALO Self Confidence Rating	1994-98, 2000, 2005-11
ALO Human Relations Rating	1994-98, 2000, 2005-11
ALO Planning Rating	1994-98, 2000, 2005-11
ALO Comm Skills Rating	1994-98, 2000, 2005-11
ALO Leadership Rating	1994-98, 2000, 2005-11
ALO Motivation Rating	1994-98, 2000, 2005-11
ALO Preparation Rating	1994-98, 2000, 2005-11
All-State Count	1982-83, 1994-99, 2003-11
Team Captain Count	1982-83, 1994-99, 2003-11
Varsity Count	1982-83, 1994-99, 2003-11
Letter Count	1982-83, 1994-99, 2003-11
Candidate Fitness Assessment Score	1982-2011
Prior Academic Record Score	1982-2011
Prior Service ADR	1982-2011
Prep School	1982-2011
Community Activity	1994-2011

Table 4.5.2-Continued

Variable	Data Available for Class Years
Extra-Curricular Activity	1994-2011
Special Recognition	1994-2011
Student Government	1994-2011
Team Captain	1994-2011
Work Experience	1994-2011
Scout	1982-83, 1994-99, 2004-11
Class President	1999-2009, 2011
Honor Society Leader	1999-2009, 2011
Honor Society Member	1999-2009, 2011
Junior ROTC	2003, 2005, 2006
Civil Air Patrol	1982-83, 1994-2011
Orchestra Leader	1999-2009, 2011
Orchestra Member	1999-2009, 2011
Band Leader	1999-2011
Band Member	1999-2009, 2011
Parent Academy	1982-2010
Parent Military	1982-2010
Sibling Academy	1982-99, 2001-11
Prior College	1982-2011
Athletic Recruit	1982-84, 1986-2011
Entry Age	1982-2011
Gender	1982-2011
Race	1982-2011
Region	1982-2011

Table 4.5.3
Means and Standard Deviations for Continuous Admission Variables Over the Years They Are Available in the Sample

Variable	Mean	Std Dev
Lead Comp	1,702.7	190.5
Aca Comp	3,180.9	289.8
Sel Comp	792.3	49.8
ACT/SAT Concor	1,296.3	103.9
ACT/SAT Verb	636.5	66.5
ACT/SAT Math	668.1	64.1
AAS	567.3	104.3
NAAS	575.7	98.7
ALO Final Rtg	555.8	67.5
ALO Rec	4.7	.48
ALO SC	4.8	.48
ALO HR	4.7	.53
ALO PL	4.8	.47
ALO CS	4.6	.56
ALO Lead	4.6	.54
ALO Mot	4.8	.48
ALO Prep	4.6	.57
AS Count	.80	1.33
TC Count	1.10	1.34
Var Count	5.23	2.54
Let Count	3.45	2.42
CFA	492.4	95.4
PAR	646.2	93.5

Results

Two approaches for evaluating elements of information used in a selection process are presented in this section. The first approach seeks to determine if selection information before admission to the Academy shows a significant association with holding a line position. These results clarify which admission variables measure something of interest in predicting the outcome. The second approach seeks to expand on the first approach by determining which admission variables measure something of interest for predicting the outcome *that other admission variables do not measure*. In other words, the second approach looks at the predictive value of each admission variables holding other admission variables constant.

Table 4.5.4 displays results for the first approach. Correlations between each admission variable and participation in a line position are presented in column 5. Most of the admission variables had significant and positive correlations with holding a line position. A few variables, such as all-state count, prep school, ROTC, athletic recruit, black, Hispanic, and Asian had significant and negative correlations with holding a line position. Because of the large sample sizes used when calculating many of the correlations, even small correlations were statistically significant. The coefficients for each admission variable from a bivariate logistic regression predicting participation in a line position are presented as average marginal effects in column 6. *p*-values listed in column 7 are for a two-tailed *z*-test which tests if the coefficients in column 6 are different from zero. Average marginal effects range from -4.3% to 6.9%. The honor society leader variable had the largest average marginal effect listed in the table. For Academy class years 1999-2009 and 2011, cadets who were honor society leaders in high school were 6.9 percentage points more likely to hold a line leadership position than cadets who were not honor society leaders in high school. For Academy class years 1982-1984 and 1986-2011, cadets who were recruited athletes were 5.3 percentage points less likely to hold a line leadership position than cadets who were not recruited athletes.

While the first approach provides information about the isolated value of each admission variable, the admission process considers many elements of information. It is important to understand the relationship between each admission variable and participation in a line position outcome in the context of other admission variables available. Table 4.5.5 displays results from four multivariate logistic models using multiple admissions variables to predict participation in a line position.

The selection composite score calculated by the Academy Admission Department that is used as the primary admission decision metric combines three composite scores: leadership composite, academic composite, and selection panel rating. Model A contains the three admission composite scores that contribute to the selection composite score along with demographic information and an indicator variable for whether the applicant was an athletic recruit for class years 1982-1984 and 1986-2011. The coefficients for each variable in Model A are presented as average marginal effects Table 4.5.5. Each of the composite scores showed a significant and positive association with holding a line leadership position when the other composite scores and demographic variables are held constant.

A one standard deviation increase in leadership composite was associated with a 2.8 percentage point increase in the likelihood of participating in a line leadership position at the Academy. Similarly, a one standard deviation increase in academic composite was associated with a 2.8 percentage point increase in the likelihood of participating in a line leadership position at the Academy. Individuals recruited to participate on an athletic team at the Academy were 3.7 percentage points less likely on average to hold a line leadership position than individuals not recruited to participate on an athletic team. Several demographic variables in the model also showed significant associations with participation in a line position. Males were 4.1 percentage points more likely to hold a line position than females for the model sample. Hispanics were 2.4 percentage points less likely to hold a line position than whites. Asians were 3.4 percentage points less likely to hold a line position than white. A one year increase in age was

associated with a .8 percentage point increase in the likelihood of holding a line position.

Model B contains sub-composite scores that contribute to the leadership, academic, and selection panel composite scores used in Model A for class years 1982-1984, 1986-1999, and 2001-2011. For example, the athletic activity score and non-athletic activity score are used in the calculation for the leadership composite. Demographic information is also included in the model. Most of the admission variables had significant and positive associations with participation in a line position. Prior active duty regular service showed the largest average marginal effect for the admission variables. Individuals with prior active duty regular service were 3.5 percentage points more likely on average to hold a line position than individuals without prior active duty regular service holding other variables constant. Attending a preparatory school is negatively associated with participation in a line position. Individuals attending a preparatory school were 1.8 percentage points less likely on average to hold a line position than individuals who did not attend a preparatory school.

The specification of Model C is similar to Model B with the exceptions that Academy Liaison Officer (ALO) ratings are included and the sample of class years is smaller. The sample is smaller because ALO ratings are only available for class years 1994-1998 and 2005-2011. Results from Model C are mostly consistent with the Model B results. The average marginal effect for preparatory school attendance was -1.8% in Model B but jumps to -5.9% in Model C. The only ALO ratings with significant relationships to holding a line position were the human relation rating and the leadership rating. A one unit increase in ALO human relation rating was associated with a 2.6 percentage point increase in the likelihood of holding a line position. A one unit increase in ALO leadership rating was associated with a 1.8 percentage point increase in the likelihood of holding a line position. This finding may indicate human relation and leadership skills are more for important for earning a line position than the other skills evaluated by the ALO. It may also be the case that all of the skills evaluated are important for earning a line position, but the ALOs are best able

to assess human relation and leadership skills in their contact with applicants.

The Academy Admission Department combines the ALO ratings shown in Model C into a final ALO rating. The specification of Model D is identical to Model C with the exception that the final ALO rating is included instead of the ALO sub-scores. The average marginal effect for the final ALO rating was significant and positive in Model D. A one unit increase in final ALO rating was associated with a 2.0 percentage point increase in the likelihood of holding a line position at the Academy.

It is possible to compare the predictive ability of Model C to Model D using the area under the receiver operating characteristic (ROC) curves for the two models (Cleves, 2002, pp. 301-13). Since Model C and Model D are identical except that the ALO sub-scores from Model C are aggregated into a final ALO score in Model D, I can compare the predictive ability of the two models as a way of assessing whether the ALO sub-scores are properly weighted when creating the aggregate score to maximize the predictive value of the information (Guion, 2011, p. 270). If Model C has greater predictive ability than Model D, this suggests that the weighting of the ALO sub-scores when they are aggregated to a final ALO score could be improved. The area under the Model C ROC curve is .6342. The area under the Model D ROC curve is .6301. The *p*-value from a chi-squared test comparing the area under the Model C ROC curve and the Model D ROC curve is .029. Using a significance level of .05, this finding indicates the predictive ability of Model C is greater than Model D.

Table 4.5.4
Leadership-Related Admission Variables and Demographic Variables Predicting Line Position Participation: Bivariate Logistic Regression

Admission Variable	Number of Cadets in Group[a]	Sample Size	Cadets With a Line Position in the Sample	Corr. With Line[c]	Average Marginal Effect	*p*-value
Continuous Admission Variables[b]						
Leadership Composite	-	40,471	5,221	.09**	3.1%**	.000
Selection Composite	-	38,732	5,169	.12**	4.3%**	.000
Academic Composite	-	40,468	5,221	.10**	3.4%**	.000
ACT SAT Concordance	-	40,466	5,221	.06**	1.9%**	.000
ACT SAT Verb Concordance	-	40,467	5,221	.04**	1.4%**	.000
ACT SAT Math Concordance	-	40,468	5,221	.04**	1.4%**	.000
Athletic Activity Score	-	40,468	5,221	.03**	.9%**	.000
Non-Athletic Activity Score	-	40,468	5,221	.08**	2.8%**	.000
ALO Final Rating	-	12,433	1,954	.04**	1.5%**	.000
ALO Recommendation	-	12,424	1,960	.05**	2.1%**	.000
ALO Self Confidence Rating	-	12,423	1,960	.05**	1.8%**	.000
ALO Human Relations Rating	-	12,423	1,960	.06**	2.5%**	.000
ALO Planning Rating	-	12,423	1,960	.03**	1.1%**	.001
ALO Comm Skills Rating	-	12,423	1,960	.05**	1.9%**	.000
ALO Leadership Rating	-	12,423	1,960	.06**	2.4%**	.000
ALO Motivation Rating	-	12,424	1,960	.04**	1.7%**	.000
ALO Preparation Rating	-	12,423	1,960	.03**	.9%**	.005
All-State Count	-	19,038	2,827	-.02*	-.7%*	.010
Team Captain Count	-	19,038	2,827	.02*	.5%*	.034
Varsity Count	-	19,038	2,827	.01	.4%	.118
Letter Count	-	19,038	2,827	.02**	.7%**	.003
Dichotomous Admission Variables						
Prior Service ADR	1,312	41,206	5,221	.01	2.1%*	.034
Prep School	7,351	41,206	5,221	-.02**	-2.0%**	.000
Community Activity	15,189	23,815	3,302	.07**	5.1%**	.000
Extra-Curricular Activity	17,166	23,815	3,302	.07**	5.6%**	.000
Special Recognition	9,452	23,815	3,302	.05**	3.8%**	.000
Student Government	8,431	23,815	3,302	.08**	5.8%**	.000
Team Captain	9,628	23,815	3,302	.07**	5.2%**	.000

Table 4.5.4-Continued

Admission Variable	Number of Cadets in Group[a]	Sample Size	Cadets With a Line Position in the Sample	Corr. With Line	Average Marginal Effect	*p*-value
Work Experience	9,681	23,815	3,302	.04**	3.1%**	.000
Scout	4,866	21,707	2,930	.02**	1.9%**	.001
Class President	1,653	17,358	2,414	.06**	6.7%**	.000
Honor Society Leader	1,138	15,921	2,226	.05**	6.9%**	.000
Honor Society Member	10,289	15,921	2,226	.07**	5.0%**	.000
Junior ROTC	401	3,748	492	-.02	-1.9%	.274
Civil Air Patrol	2,066	26,770	3,605	.01	.9%	.270
Orchestra Leader	348	15,213	2,197	.01	1.7%	.396
Orchestra Member	1,117	15,213	2,197	.00	-.5%	.634
Band Leader	1,460	17,358	2,414	.02*	2.1%*	.035
Band Member	3,246	15,921	2,226	.02*	1.7%*	.015
Parent Academy	1,488	39,836	5,036	.02**	4.2%**	.000
Parent Military	10,359	39,836	5,036	.02**	1.8%**	.000
Sibling Academy	3,294	39,947	5,049	.02**	3.3%**	.000
Prior College	4,138	41,206	5,221	.02**	2.3%**	.000
Athletic Recruit	8,281	39,714	5,076	-.05**	-4.3%**	.000
Demographic Variables						
Entry Age	-	40,765	5,220	.01*	.4%*	.025
Gender	-	-	-	-	-	-
Female (Base Level)	6,126	41,206	5,221	-	-	-
Male	35,080	41,206	5,221	.04**	3.4%**	.000
Race						
Caucasian (Base Level)	33,173	40,473	5,205	-	-	-
Black	2,432	40,473	5,205	-.03**	-3.8%**	.000
Hispanic	2,381	40,473	5,205	-.02**	-2.8%**	.000
Asian	1,659	40,473	5,205	-.02**	-2.9%**	.000
Other	828	40,473	5,205	-.01	-2.6%*	.020

Table 4.5.4-Continued

Admission Variable	Number of Cadets in Group[a]	Sample Size	Cadets With a Line Position in the Sample	Corr. With Line	Average Marginal Effect	*p*-value
Region						
Northeast (Base Level)	5,723	39,779	5,146	-	-	-
Midwest	9,248	39,779	5,146	.00	.0%	.786
South	13,513	39,779	5,146	-.01**	-.1%	.082
West	10,412	39,779	5,146	.01	.0%	.696
Other	883	39,779	5,146	.00	.0%	.985
Class Years						
1982-84 (Base Level)	4,532	41,206	5,221	-	-	-
1985-86	2,974	41,206	5,221	-.02**	.6%	.423
1987-89	4,318	41,206	5,221	-.01*	1.9%	.004
1990-92	4,174	41,206	5,221	-.01	2.2%	.001
1993-95	4,174	41,206	5,221	-.01	2.3%	.001
1996-98	3,676	41,206	5,221	.02**	5.2%	.000
1999-01	3,761	41,206	5,221	.01*	4.2%	.000
2002-04	4,019	41,206	5,221	.00	2.6%	.000
2005-07	3,941	41,206	5,221	.01*	4.2%	.000
2008-11	5,637	41,206	5,221	.03**	5.2%	.000

NOTE: Each line of the table presents results from a unique logistic regression model with line position as the outcome and one admission variable as a predictor. *p*-values are for a two-tailed *z*-test comparing the average marginal effect from the logistic regression to zero, *p<.05, **p<.01

[a] Displayed for dichotomous admission variables only.

[b] The average marginal effects for continuous admissions variables were multiplied by the standard deviation of the variable. The average marginal effect for these variables should be interpreted as the effect for a one standard deviation increase in the variable.

[c] Raw correlations involving a dichotomous variable should not be interpreted with the standard rules of thumb used for two continuous variables.

Table 4.5.5
Admission and Demographic Variables Predicting Line Position Participation: Four Multivariate Logistic Regression Models

	Model A		Model B		Model C		Model D	
Class Years in Sample	1982-84, 1986-2011		1982-84, 1986-99, 2001-11		1994-98, 2005-11		1994-98, 2005-11	
Sample Size	36,574		35,785		10,392		10,392	
Cadets With a Line Position	4,950		4,653		1,659		1,659	
	Average Marginal Effect[a]	*p*-value	Average Marginal Effect[a]	*p*-value	Average Marginal Effect[a]	*p*-value	Average Marginal Effect[a]	*p*-value
Admission Variable								
Leadership Composite	3.0%**	.000	-	-	-	-	-	-
Academic Composite	2.8%**	.000	-	-	-	-	-	-
Gender								
Female (Base Level)	-	-	-	-	-	-	-	-
Male	4.1%**	.000	4.5%**	.000	4.4%**	.000	4.3%**	.000
Race								
Caucasian (Base Level)	-	-	-	-	-	-	-	-
Black	-.8%	.350	-.6%	.469	2.5%	.286	2.8%	.232
Hispanic	-2.1%**	.003	-2.0%**	.008	-2.2%	.166	-2.1%	.183
Asian	-3.4%**	.000	-3.1%**	.000	-4.8%**	.001	-4.8%**	.001
Other	-2.3%	.045	-2.2%	.070	-2.0%	.356	-2.0%	.358
Region								
Northeast (Base Level)	-	-	-	-	-	-	-	-
Midwest	-1.0%	.086	-1.5%*	.014	-2.0%	.120	-2.2%	.088
South	-1.2%*	.031	-1.9%**	.001	-3.7%**	.002	-3.8%**	.002
West	.3%	.611	-.6%	.360	-1.6%	.202	-1.8%	.157
Other	.6%	.659	-1.5%	.245	-2.0%	.434	-2.1%	.419
Entry Age	.7%**	.001	.6%*	.049	1.3%*	.048	1.3%*	.043
Athletic Recruit	-3.4%**	.000	-3.5%**	.000	-3.2%**	.002	-3.2%**	.002

Table 4.5.6-Continued

	Model A		Model B		Model C		Model D	
	Average Marginal Effect[a]	*p*-value	Average Marginal Effect[a]	*p*-value	Average Marginal Effect[a]	*p*-value	Average Marginal Effect[a]	*p*-value
Class Years								
1982-84 (Base Level)	-	-	-	-	-	-	-	-
1985-86	1.3%	.207	1.3%	.188	-	-	-	-
1987-89	2.4%**	.002	1.8%*	.013	-	-	-	-
1990-92	.6%	.412	.5%	.510	-	-	-	-
1993-95	-.2%	.803	.6%	.366	-	-	-	-
1996-98	2.2%**	.004	2.8%**	.000	3.3%**	.002	3.3%**	.002
1999-01	2.2%**	.005	3.1%**	.000	-	-	-	-
2002-04	.9%	.232	1.7%*	.023	-	-	-	-
2005-07	2.3%**	.003	3.9%**	.000	3.2%**	.003	3.2%**	.002
2008-11	3.5%**	.000	5.5%**	.000	5.2%**	.000	4.9%**	.000
Athletic Activity Score	-	-	1.5%**	.000	1.8%**	.000	1.8%**	.000
Non-Athletic Activity Score	-	-	2.1%**	.000	2.0%**	.000	2.1%**	.000
CFA	-	-	1.3%**	.000	1.5%**	.000	1.5%**	.000
Prior Academic Record	-	-	2.7%**	.000	2.5%**	.000	2.5%**	.000
ACT/SAT Concordance	-	-	.6%**	.005	.2%	.557	.2%	.587
Prior Service ADR	-	-	4.3%**	.004	1.6%	.677	1.6%	.685
Prep School	-	-	-1.9%**	.000	-4.2%*	.061	-4.5%*	.038
Parent Academy	-	-	2.2%*	.024	2.9%	.097	2.7%	.126
Parent Military	-	-	1.8%**	.000	1.7%	.077	1.5%	.112
Academy Sibling	-	-	2.6%**	.000	4.1%**	.003	3.8%**	.004
Prior College	-	-	1.8%*	.010	2.0%	.243	1.7%	.302
Academy Liaison Officer								
Human Relation Rating	-	-	-	-	2.3%**	.008	-	-
Planning Rating	-	-	-	-	-.9%	.310	-	-
Comm Skill Rating	-	-	-	-	1.5%*	.046	-	-
Leadership Rating	-	-	-	-	2.1%*	.015	-	-

Table 4.5.6-Continued

	Model A		Model B		Model C		Model D	
	Average Marginal Effect[a]	*p*-value	Average Marginal Effect[a]	*p*-value	Average Marginal Effect[a]	*p*-value	Average Marginal Effect[a]	*p*-value
Motivation Rating	-	-	-	-	1.0%	.309	-	-
Preparation Rating	-	-	-	-	-1.1%	.121	-	-
Recommendation	-	-	-	-	.0%	.988	-	-
Final Rating	-	-	-	-	-	-	1.8%**	.000

NOTE: Four logistic regression models are presented in this table. Each model uses participation in a line position as the outcome variable, but the composition of predictors varies according to the availability of data. *p*-values are for a two-tailed *z*-test comparing the average marginal effect from the logistic regression to zero, *$p<.05$, **$p<.01$

[a] The average marginal effects for continuous admissions variables were multiplied by the standard deviation of the variable. The average marginal effect for these variables should be interpreted as the effect for a one standard deviation increase in the variable.

Discussion

Most of the measures in the admissions process aimed at evaluating an applicant's leadership ability such as the leadership composite, athletic activity score, and ALO ratings showed a significant and positive association with participation in a line leadership position at the Academy in bivariate models. This finding suggests that if the Academy desires the applicants who score highly on leadership-related admission criteria to advance to prominent cadet leadership positions, this process is working as intended.

All-state count was negatively associated with participation in a line leadership position. This athletic performance measure was associated with a greater likelihood of being a recruited athlete.[20] Since participation on an athletic team at the Academy requires a large time commitment, cadets on athletic teams might be less willing to take on the responsibility of being a line officer. Therefore, it is not surprising that individuals with a high all-state count in high school held line positions at lower rates.

The large positive average marginal effects for individuals who were a class president, honor society leader, or participated in student government stand out among the admission variables examined. Because models used to determine these effects do not include other covariates, it is not possible to know what part of this association was due to these indicator variables acting as signals of underlying abilities vs. acting as signals of the value of holding one of these high school positions. It is possible that the process of becoming a class president, honor society leader, or student government official requires the individual to compete for the position and demonstrate worthiness to fulfill responsibilities of the position. This competition may prepare the individual to compete more successfully for a line position at the Academy.

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[20] All-state count, team captain count, varsity count, and letter count are all significantly positively correlated with being a recruited athlete.

Several demographic variables exhibited interesting relationships with participation in a line position. The fact that female and non-white cadets were less likely to hold line positions than male and white cadets respectively could be explained as being a product of cadet preferences, differences between groups on other measures, or bias. Females and non-whites may have applied for line positions at lower rates than men and whites respectively. For example, females and non-whites may have preferred to participate in other activities at the Academy other than line positions. There is some evidence that on average whites have slightly more extraverted personalities than blacks or Asians (Foldes, Duehr, and Ones, 2008, pp. 593-96). Personality differences between racial groups may have affected the number of people from each racial group willing to apply for a line position. Females and non-whites may have had lower scores than men and whites respectively on the factors considered in the selection process for line position. Another possibility is that females and non-whites may have been selected at lower rates for line positions due to a bias for men and whites in the selection process. Investigating the causes of participation differences would be a useful extension of this work.

Results from the four multivariate models specified for this research question allow for a discussion of the relationship between key admission variables and participation in a line position without the influence of some obvious confounding variables. Model A shows the leadership composite and academic composite had significant relationships with participation in a line position when included in a model simultaneously. This fact indicates academic factors are also important for understanding leadership emergence in addition to leadership factors.

The measures evaluated for admission to the Academy cover a wide conceptual range because the Academy desires to admit cadets who can excel in academics, military responsibilities, and athletics while demonstrating exceptional character. This finding that leadership composite and academic composite were both significant predictors of participation in a line position suggests that neat divisions may not exist between these performance areas such that information about an

applicant's academic ability, athletic ability, and character are all important to understanding the leadership potential of an individual.

Model B supports the idea that measures not obviously related to leadership are important predictors of participation in a leadership position. Prior academic record, SAT/ACT concordance score, and athletic activity score were all significant predictors of holding a line position. The large average marginal effect of having prior active duty regular service stands out in this model. Enlisted airmen wishing to apply to the Academy must receive the endorsement of their commander.[21] It is possible the endorsement of a commander signals something about an applicant's preparedness to pursue and accept leadership responsibility. It is also possible that the experience of serving as an airman prepares an individual to emerge as a line leader at the Academy. Being a subordinate in the active duty Air Force may give prior service applicants valuable experience observing leaders and developing leadership principles for interacting with subordinates.

The average marginal effect of attending a preparatory school on the probability of participating in a line position was higher in Models C and D than in Model B. Model B contains a greater number of class years. I suspect a selection policy change for the preparatory schools, or a change in the training regimen at the prep schools at some point in the timeframe covered by the sample might explain this difference. Comparing the selection process and curriculum for Academy preparatory schools over time would further illuminate this finding but is beyond the scope of this study.

Because Model C had a greater ability to predict participation in a line position than Model D, as shown by a difference in the area under the ROC curves for the two models, I suggest the Academy revisit the weights applied to the ALO sub-scores when creating the aggregate final ALO score. Model C suggests that the ALO human relations and leadership ratings may warrant greater weight in the aggregation

[21] Enlisted Airmen must receive the signature of their commander on AF IMT 1786 before applying to the Academy.

calculation. If the Academy intends the ALO final rating to act as a predictor of something other than emerging as a cadet line leader, further analysis could test the final ALO rating's ability to predict a different outcome such as graduation or cumulative MPA.

5. Policy Recommendations

This dissertation aims to improve officer effectiveness by informing three types of decisions made by Academy administrators: leadership position curricula decisions, cadet leader selection decisions, and admission decisions.

Leadership Position Curricula Decisions

Many types of leadership positions exist at the Academy. The designs of these types differ in notable ways such as assigned responsibilities, duration of responsibility, and amount of discipline authority. The logistic regression and propensity weighted logistic regression results in section 4.2 at a minimum showed holding a cadet line position was related to a higher likelihood of promotion and at most showed that cadet line positions caused an improved likelihood of promotion. This dissertation then showed how the responsibilities associated with the cadet line positions resemble generic junior officer responsibilities and argued that cadet line leadership positions appear to prepare cadets for success as junior officers. According to these conclusions, I submit the following policy recommendations:

1) Create more cadet line positions. The empirical relationship between participation in a line position and promotion was consistent and meaningfully large. The Academy should attempt to maximize the training value from these positions by exposing as many cadets as possible to the experience of participating in a line position. This policy change could be achieved by increasing the number of squadrons and groups. Reducing the amount of time a line leader holds the position could also create more opportunities for cadets to receive line leadership experience. It should be noted that such changes may impact the effectiveness of the training. Reevaluating effectiveness after the changes are made is recommended.

2) Structure other cadet leadership positions to resemble the line positions. Cadet leadership positions other than line positions may be

improved by making adjustments that increase the amount of similarity between those positions and the line positions on the six dimensions characterizing cadet leadership positions described in section 4.2 (duration of authority, organizational structure, discipline authority, level, contact with subordinates, and contact with superiors). For example, cadet aviation leaders and athletic team captains may be given greater authority to discipline their subordinates for poor behavior. Also, the Academy should work to duplicate the feedback and mentorship typical of interactions between cadet line leaders and their superior officers for other position type. In general, the line leadership position type should act as a model of an effective leadership position at the Academy.

CADET LEADER SELECTION DECISIONS

Deciding whom to provide with a cadet line leadership opportunity is a challenging policy problem. This dissertation offers insight into who benefits most from holding a line position and highlights several groups who are underrepresented as line leaders. Deciding exactly how to weight information about merit, expected effectiveness of training, and diversity in the selection procedure depends on organizational objectives. For example, does the Academy desire to focus on training a small group of cadets to reach their highest potential or do they desire to train all cadets to reach a certain level of capability? This dissertation presents several policy recommendations to consider in light of organizational objectives:

3) Reduce cadet line position selection rate differences between racial and gender groups. For the sample in this study, black, Hispanic, and Asian cadets were less likely to hold a line leadership position than Caucasians. Females were also less likely to hold a line leadership position than males. I also found evidence that Hispanics, Asians, and females were less likely to hold line leadership positions even after controlling for some performance information like leadership composite, academic composite, and SAT/ACT concordance score. In the Military Leadership Diversity Commission's report released in March 2011, the commission expressed a desire that the military resemble the

ethnic composition of the nation and offer equal promotion opportunities for male and female members (Scarborough, 2011). Stewart and Firestone (2001, p. 233) argued that past overrepresentation of white men in the U.S. officer corps may result in identification of white, male characteristics as those characteristics most associated with officer success by recruiters for officer accession programs. The possibility that overrepresentation of white males may continue in the absence of deliberate adjustment is a strong argument for policy intervention. This dissertation found a significant relationship between holding a cadet line position and promotion to at least Lieutenant Colonel in the Air Force. Reducing differences in line position participation rates between racial and gender groups might serve to improve the representation of minorities and females in the senior officer ranks.

4) Establish a formal method for evaluating cadets' developmental readiness to lead and include that information in selection decisions. The groups of cadets with low 2-YR MPA or 2-YR GPA who are selected to participate in cadet line positions had significantly higher probabilities of promotion to LTC than cadets with similar 2-YR MPA or 2-YR GPA respectively. Part of the explanation for this finding may be that these cadets were able to signal their motivation and readiness to hold a leadership position in informal ways to the people making the selection decision. If the Academy made a conscious effort to measure cadets' readiness for a developmental experience, I suspect the average benefits from leadership participation would only increase.

Avolio and Hannah (2008, p. 346) presented survey instruments designed to measure developmental readiness concepts such as self-concept clarity, self-awareness, goal orientation, metacognitive ability, self-complexity, and developmental efficacy. Administering one or several of these survey instruments to leadership position applicants could serve as part of the evaluation of their developmental readiness.

Adjusting the content and increasing the structure of the applicant interview could also serve as part of the evaluation method. In a meta-analysis of selection interviews, Conway, Jako, and Goodman

(1995, p. 576) concluded that increasing the standardization of interviews improves interrater reliability and might improve construct validity. Huffcut and Roth (1998, p. 179) meta-analyzed employment interviews and found racial group differences in interview ratings are lower for high-structure interviews than for low-structure interviews. These two studies indicate that implementing a structured interview process to measure readiness for cadet line positions might help improve the quality of applicant assessment by improving the reliability of interview ratings and reducing bias.

5) Specifically encourage cadets without a close family connection to the military (i.e. parent with military service, parent who attended a service academy, sibling who attended a service academy) and cadets who attended preparatory schools to pursue holding a line position as a way to develop their leadership skills. Not having a family connection to the military or attending a preparatory school was associated with a decreased likelihood of participation in a line leadership position. Matching cadet sponsors[22] who have military experience with cadets who do not have a close family connection to the military is one policy option to assist cadets without a close family connection to the military. Sponsors with military experience are likely to share information about their time in the military, and this communication may be especially valuable for those without a family connection to the military. Turner, DeBos, and Licameli (2010, p. 22) commented how sponsors at the U.S. Military Academy with Army experience provide valuable mentorship to cadets. For preparatory school attendees, emphasizing that preparatory school leadership training is not a substitute for holding a cadet leadership position may improve the percentage of prep school attendees applying for line leadership positions. Whether this would improve the number holding line positions

[22] The cadet sponsor program matches each cadet with a sponsor individual or family in the surrounding area that helps support the cadet during their time at the Academy.

would also depend on how competitive those additional applicants are in the selection process.

ADMISSION DECISIONS

Analysis of the relationship between leadership-related admission variables and participation in a cadet line position is conducted in this dissertation to clarify whether the applicants who were assessed to have high leader potential at the admission stage are advancing to line leadership positions at the Academy. Academy administrators are faced with the challenging task of adjusting the importance attached to an admission variable in the selection process based on an empirical relationship between the admission variable and a desired outcome. This analysis guides administrators in making adjustment decisions by indicating the predictive value of leadership-related admission variables. To the extent that Academy administrators view holding a cadet line positions as an important Academy outcome, I recommend the following:

6) Continue to collect admission criteria with a demonstrated relationship to holding a line position. If the Academy expects applicants who score highly on leadership-related admission criteria to advance to prominent cadet leadership positions, this dissertation has provided evidence that most of the admission variables related to leadership predict participation in a cadet line position. While admission criteria may be designed primarily to predict other outcomes such as cumulative military performance average, cumulative grade point average, or graduation, the existence of significant relationships between admission criteria and emergence as a cadet leader supports continued collection of these admission criteria to the extent that the Academy views holding a line position as a worthy outcome measure.

7) In order to use ALO scores to predict leadership emergence, reweight the ALO final score by giving more weight to the ALO human relations and leadership ratings. This reweighting may not be appropriate when using the ALO score to predict a different outcome. If the ALO final score is designed primarily to predict another outcome, I

suggest evaluating the utility of the measure in relation to that outcome and making adjustments accordingly.

Generalizability of Findings

Many similarities exist between the Air Force Academy and the other U.S. military academies. The Air Force Academy, the Military Academy, and the Naval Academy all operate four-year programs that award bachelor's degrees and officer commissions to their graduates. Each Academy also operates a one-year preparatory school. Graduates from each institution must serve on active duty for five years after graduation. DoD Directive 1322.22 (1994), the main document guiding service academy operation, groups the three service academies together in issuing policy and guidance. Boards of visitors composed of congressional members and presidential appointees exercise oversight of each Academy.

The training programs at the three academies all contain similar academic, military, and physical components. Each academy is organized as a military unit with a student chain of command mentored by commissioned and noncommissioned officers (Farrell, 2012, p. 3). All three academies offer their students opportunities to participate in leadership positions within these student command structures (Jones, 1990, p. 9).

Positions corresponding to the line, staff, BCT cadre, summer seminar cadre, summer composite group, and team captain position types examined in this dissertation exist for the Military Academy and Naval Academy. The specific responsibilities of these positions may differ by academy, but the general duties of the positions are the same. The aviation, AETC cadre, and CST cadre positions are unique to the Air Force Academy.

Although the general guidance on officer promotions is the same for all military services, the specific promotion instructions issued by each service's secretary to promotion boards can differ (DoD Directive 1320.14, 1996). Average time in grade can also vary between services within the limits established by Title 10 Section 619 of the U.S. Code.

The three academies all use highly selective admission processes assessing academic achievement, standardized test scores, leadership potential, and physical aptitude. Differences in demographic representation between the academies have been shown to exist, though the differences are small (Bell, 2003, p. 6).

Further understanding the extent to which the results from this dissertation can be applied to other academies requires several more detailed comparisons. First, it is necessary to compare individuals from the other academies to individuals in this dissertation's sample in terms of demographic information and performance scores such as standardized test scores. Second, it is necessary to compare the specific responsibilities of the leadership positions at the other academies to the Air Force Academy leadership position responsibilities. Third, it is important to compare promotion rates and criteria for promotion between the Air Force, Navy, and Army.

Generalizing the findings in this dissertation outside of a military academy context is not recommended. The environment of the Air Force Academy is likely to differ substantially from any civilian or corporate organization.

6. Suggestions For Future Research

Building an extensive body of research in many contexts is necessary for understanding a complex topic such as leadership. This dissertation adds an incremental contribution to the accumulated knowledge about leadership by providing some details about leadership training in the Air Force Academy context. I provide the following suggestions as logical extensions of this research that I believe will help to unravel some of the many mysteries of leadership.

1) Record participation in all positions intended to offer an opportunity to practice leadership at the Academy. This analysis was partly limited by the fact that participation in some positions was not recorded. Therefore, the data were unavailable to include in the analysis. For example, some of the wing staff, group staff, and squadron level positions were not recorded, so I could not examine the relationship between those positions and promotion.

2) Record who applies for each type of leadership position, so you understand the kind of cadets each position attracts. Application for a position was one variable omitted from my research that I think is important to collect. Recording this information can help defend against claims of selection bias by showing differences in application rates. Recording who applies for a position can also help administrators tailor interventions to increase application rates for groups with below average application rates.

3) Codify responsibilities of each position. I was unable to specifically highlight how some leadership position types differed from others in this dissertation because I did not possess detailed responsibilities associated with some positions. I suggest formally codifying the responsibilities of all leadership positions and adding it to "AFCW138-101: Command Duties and Responsibilities." Codifying the responsibilities will allow for a detailed comparison between the line position which showed a relationship with promotion and other positions such as athletic team captain that did not show a relationship with promotion.

4) Evaluate each of the Academy leadership positions on the six dimensions recommended in this dissertation: 1) duration of authority 2) organizational structure 3) discipline authority 4) level type (i.e. tactical, operational, strategic) 5) amount of contact with subordinates 6) amount of contact with superiors. This evaluation can then guide adjustments to the position experiences. If some positions differ greatly from the line positions on these dimensions, adjusting the content of those positions on the differing dimensions may improve effectiveness.

5) Survey line leaders to solicit their opinions about what was developmental about the line position. Despite progress in the scientific examination of leadership, leadership still remains largely a mystery residing in the minds of leaders and followers. Understanding how to train leaders requires delving into the minds of leaders to understand their perspective.

6) Assess why aviation position participation is related to a decrease in rated promotion probability. Surveying current aviation leaders about how they perceive their experience to relate to their officer career and surveying past aviation leaders about how their experience related to their officer career may help to inform why cadets participating in aviation positions are less likely to be promoted to Lieutenant Colonel in rated career fields.

7) Perform analyses similar to those presented in this dissertation on leader training programs conducted during an officer's career. Developing senior officers for the Air Force is a long process involving many programs. This dissertation only examines leadership training at the Air Force Academy, but leader training continues throughout an officer's career. Researching the training that occurs in the gap of time between commissioning and promotion to the senior officer ranks is a logical and valuable extension of this work.

APPENDIX A
QUALITY ASSESSMENT OF OFFICERS LEAVING THE SERVICE AT KEY RETENTION POINTS

As background to the analysis presented in Chapter 5, I examine average values of Academy performance variables for the group of officers leaving the Air Force and the group of officers remaining in the Air Force at key retention points. I perform this analysis to counter the claim that more skilled officers exit the military earlier than less skilled officers and therefore promotion does not represent a positive outcome measure. The quality of officers remaining in the service consistently exceeded the quality of officers exiting the service. This finding increases my confidence that promotion represents a desirable outcome measure.

In the first step of this analysis, I separate commissioned officers into rated and non-rated groups based on their Air Force Specialty Code (AFSC). Then, I plot the percentage of officers remaining in a class year cohort who left the service at each year point after graduation. These plots are shown as Figures A.1-A.4 below.

At the year points on the plots where the exit rates spike, I compare average values of Academy cumulative military performance average, cumulative grade point average, and ACT/SAT concordance score between the group of officers that exited the Air Force and the group that remained in the Air Force.[23] These mean values and *p*-values from *t*-tests between the mean values are listed in Table A.1. The group of officers remaining in the service consistently had a significantly higher mean score on each of the three performance variables than the group of officers exiting the service.

[23] These performance variables are described in more detail in Chapter 4 Tables 4.1.2, 4.2.1, and 4.2.4.

Figure A.1
Rated Officer Attrition for CY 1980-86

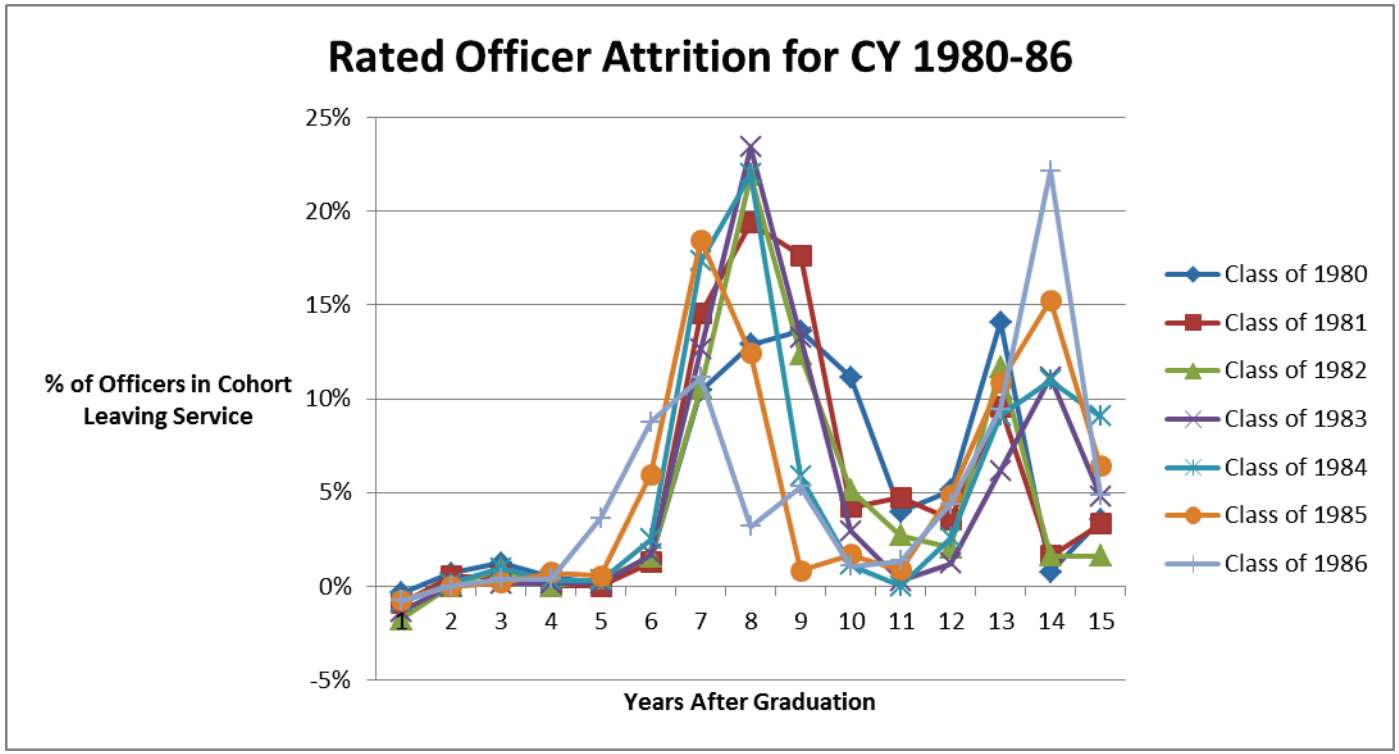


Figure A.2
Rated Officer Attrition for CY 1987-95

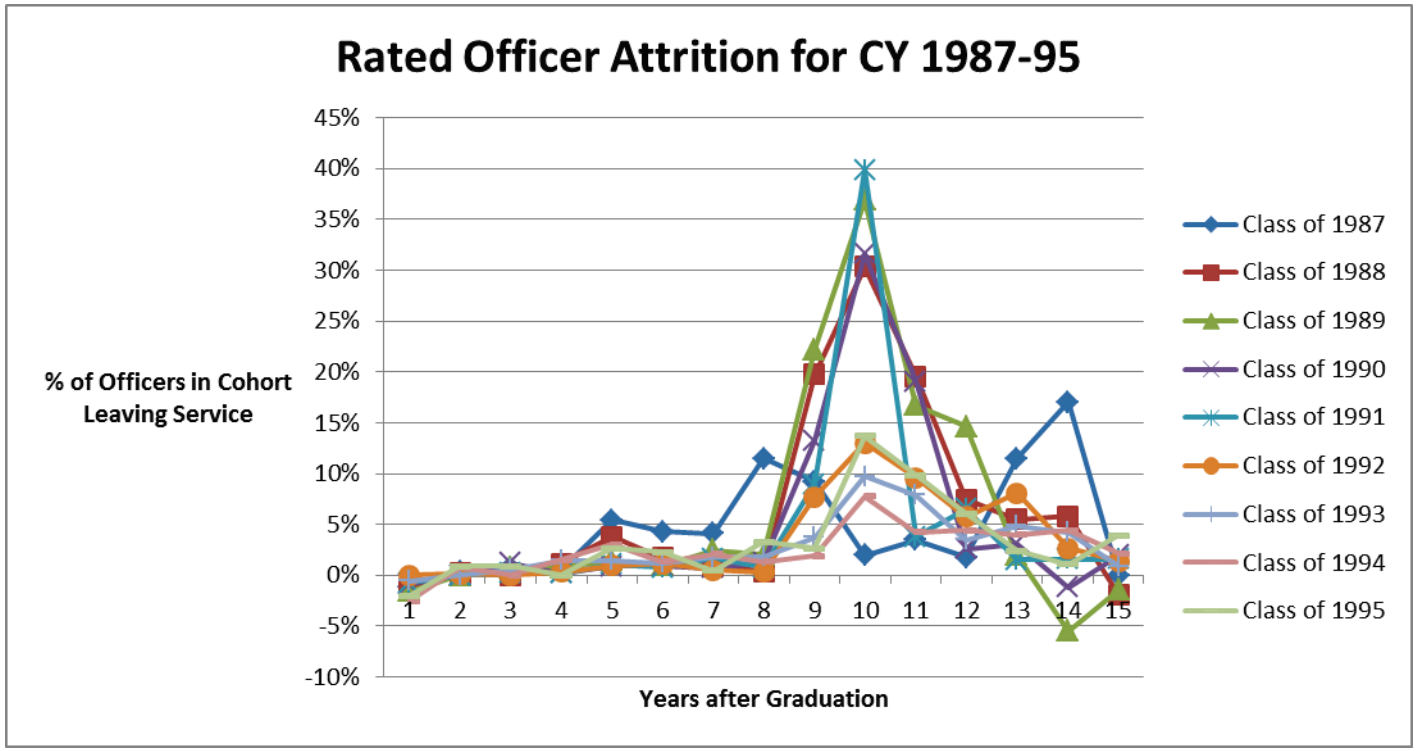


Figure A.3
Nonrated Officer Attrition for CY 1980-86

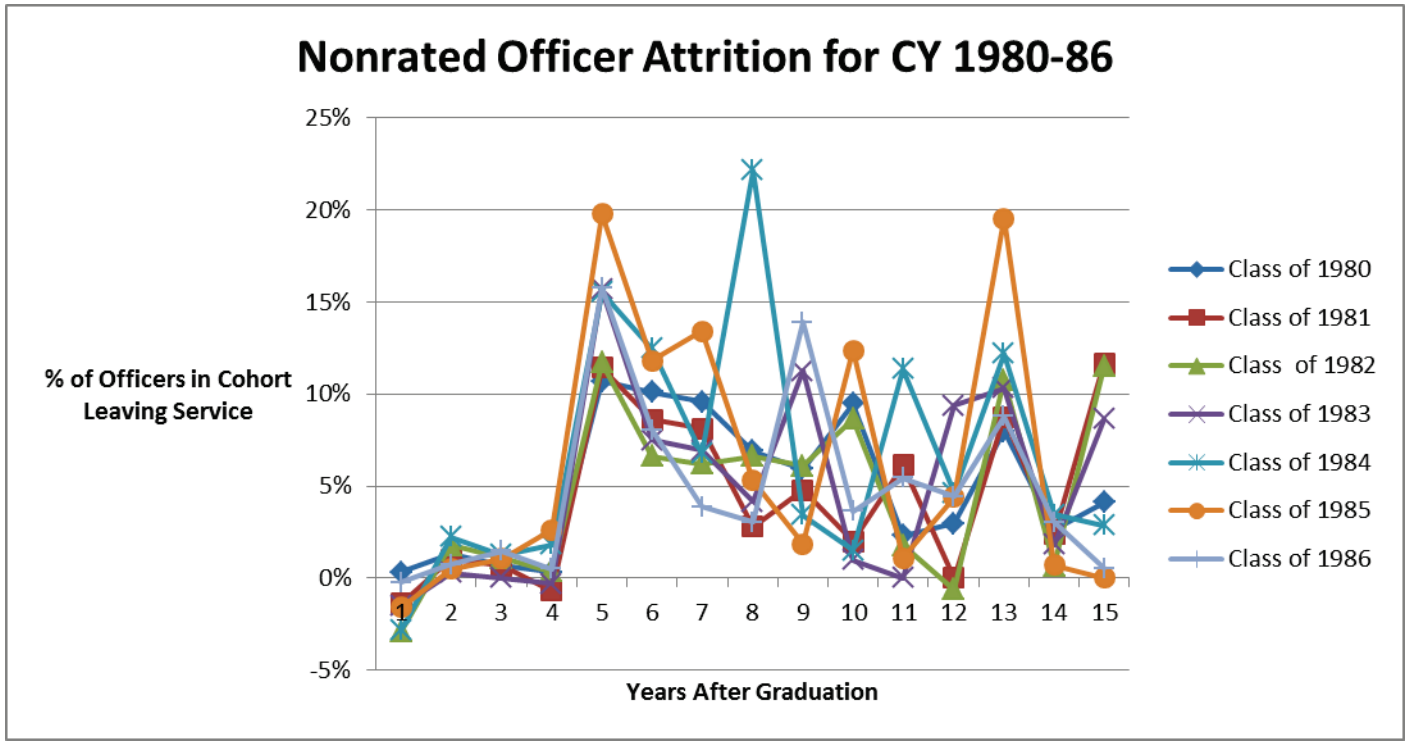


Figure A.4
Nonrated Officer Attrition for CY 1987-95

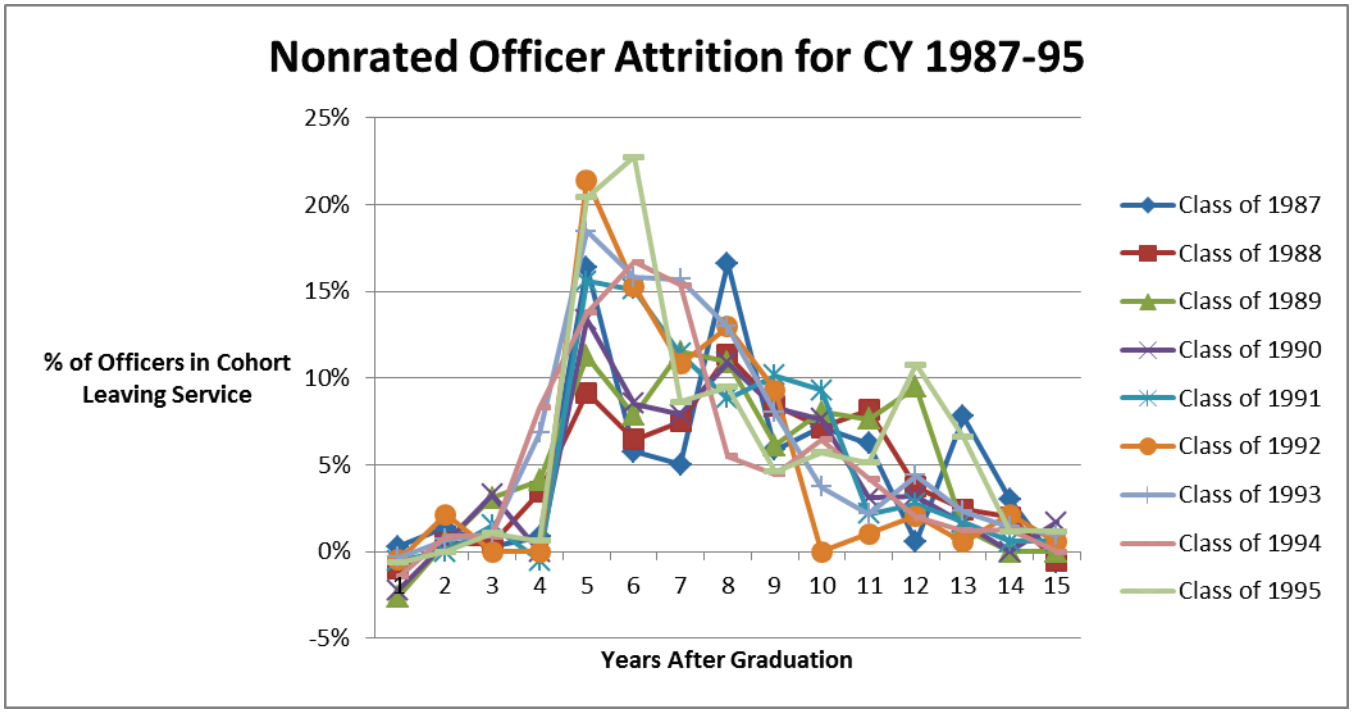


Table A.1
Comparison of Performance Measures for Officers Staying or Exiting at Key Retention Points for Class Years 1983-95

Variable	*n*	Cumulative Academy MPA Mean	*p*-value	Cumulative Academy GPA Mean	*p*-value	ACT/SAT Concor	*p*-value
Rated Career Fields	8,759						
CY 1980-86 7 years exit	509	2.85		2.76		1,291.32	
CY 1980-86 7 years stay	3,222	2.94	.000**	2.84	.001**	1,301.89	.028*
CY 1987 8 year exit	59	2.83		2.71		1,273.05	
CY 1987 8 year stay	455	2.93	.009**	2.85	.022*	1,297.65	.061
CY 1988-90 9 year exit	316	2.89		2.86		1,297.18	
CY 1988-90 9 year stay	1,394	2.94	.015*	2.86	.776	1,314.87	.001**
CY 1991-95 10 year exit	380	2.97		3.00		1,317.11	
CY 1991-95 10 year stay	1,722	2.96	.392	2.94	.019*	1,326.12	.071
CY 1980-95 exited any time before 15 years of service	4,724	2.90		2.84		1,300.58	
CY 1980-95 stayed in service for at least 15 years	4,035	2.97	.000**	2.90	.000**	1,317.11	.000**
Non Rated Career Fields	6,483						
1980-86 5 years exit	352	2.87		2.82		1,283.58	
1980-86 5 years stay	1,989	2.88	.498	2.93	.792	1,292.96	.124
1987-95 5 years exit	596	2.87		2.84		1,298.98	
1987-95 5 years stay	3,138	2.89	.082	2.85	.697	1,306.79	.072
CY 1980-95 exited any time before 15 years of service	3,803	2.86		2.82		1,296.62	
CY 1980-95 stayed in service for at least 15 years	2,680	2.91	.000**	2.88	.000**	1,306.56	.000**

*p<.05, **p<.01

APPENDIX B
MEAN PERFORMANCE SCORE COMPARISON CHARTS BY LINE POSITION TYPE FOR RESEARCH QUESTION 1

This appendix includes figures related to Research Question 1. The figures show the average value of three performance measures (2-YR MPA, 2-YR GPA, and 2-YR AMC) for each leadership position type and its corresponding comparison group. For each of the four samples described in the Research Question 1 section of the Results chapter, one chart is included for each of the three performance area for a total twelve figures. The upper and lower bounds of a 95% confidence interval are displayed with horizontal dashes above and below the mean value which is indicated by a triangle.

Figure B.1
Two-Year MPA vs. Leadership Position Type for CY 1983-95

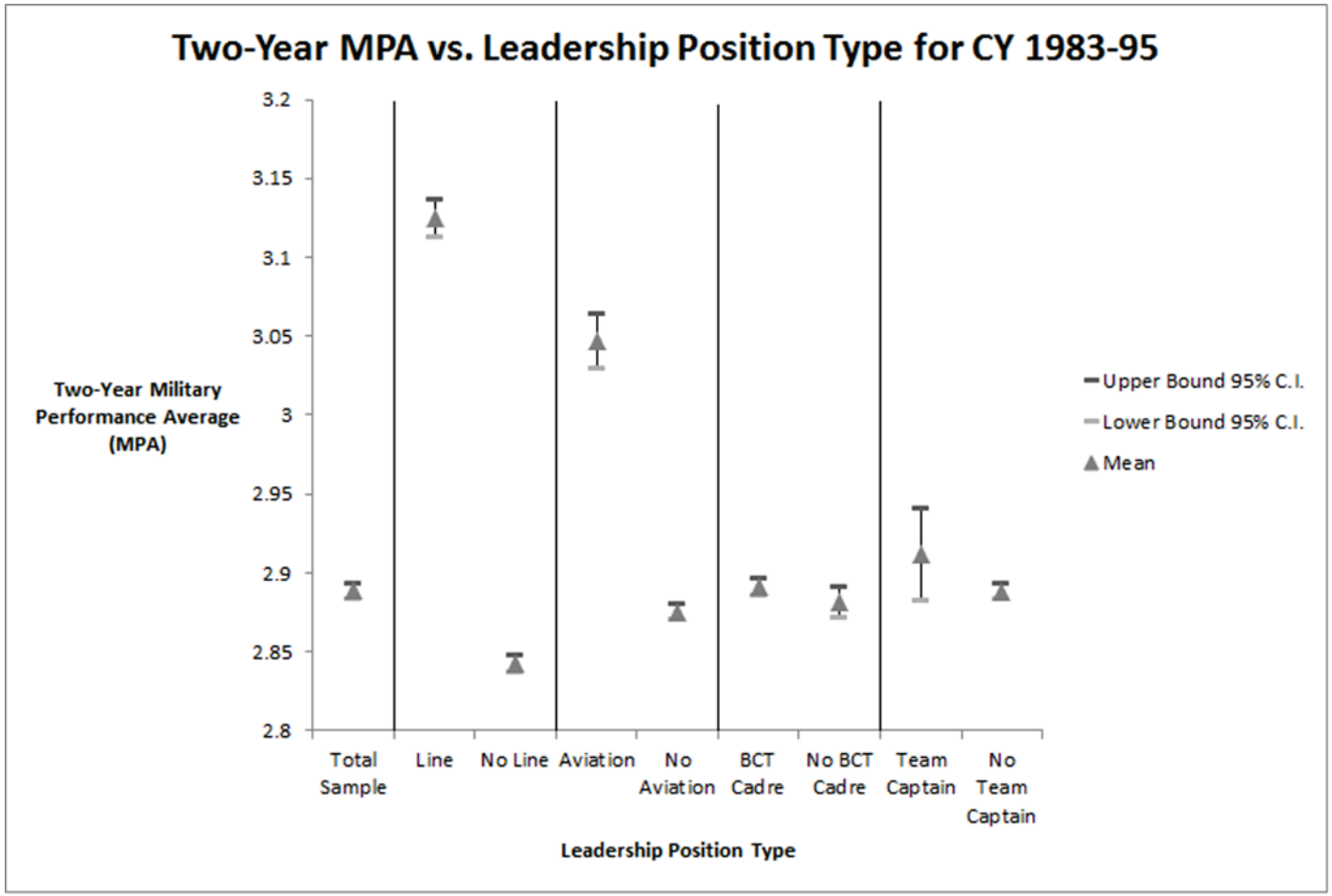


Figure B.2
Two-Year GPA vs. Leadership Position Type for CY 1983-95

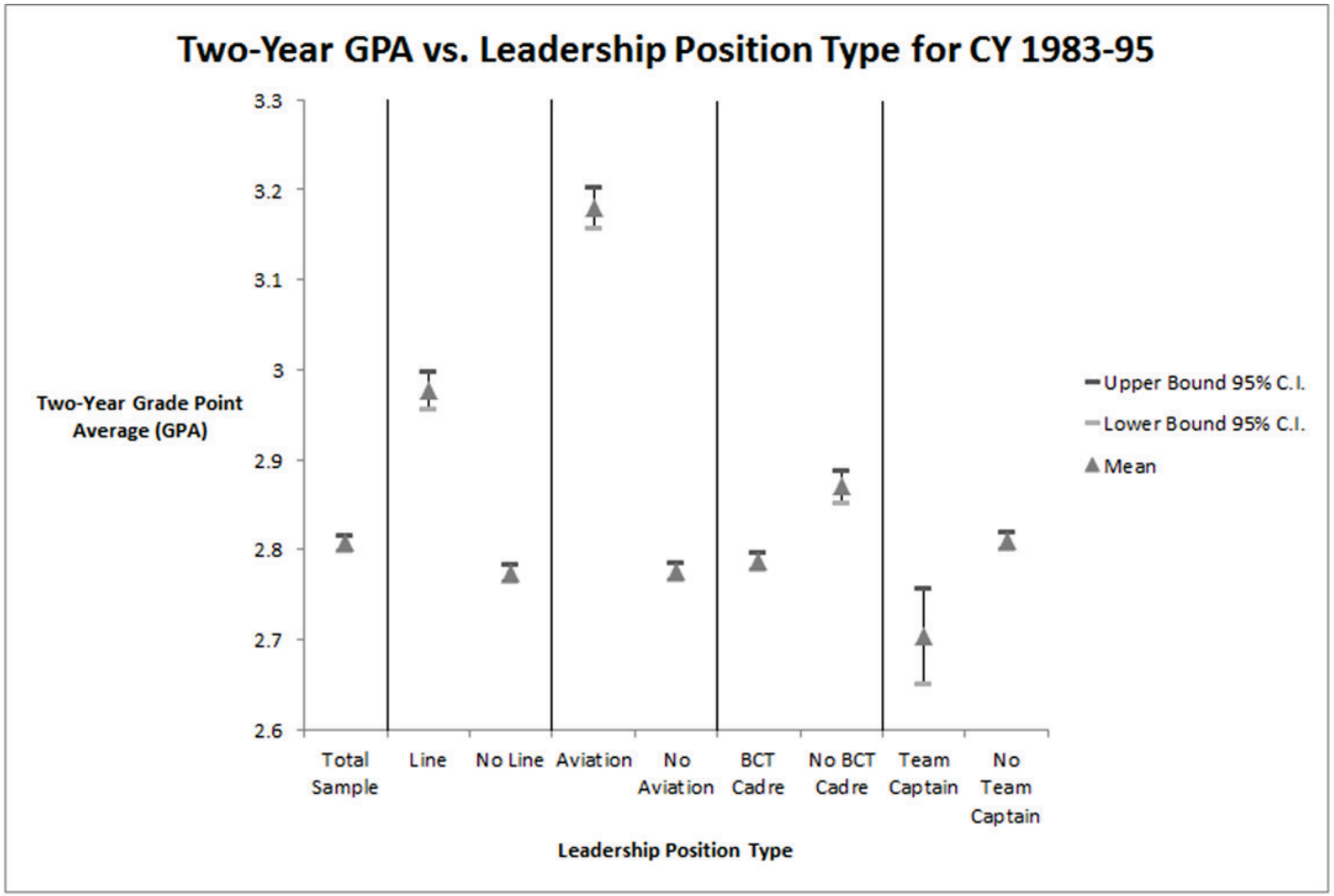


Figure B.3
Two-Year Athletic List Count Average vs. Leadership Position Type for CY 1983-95

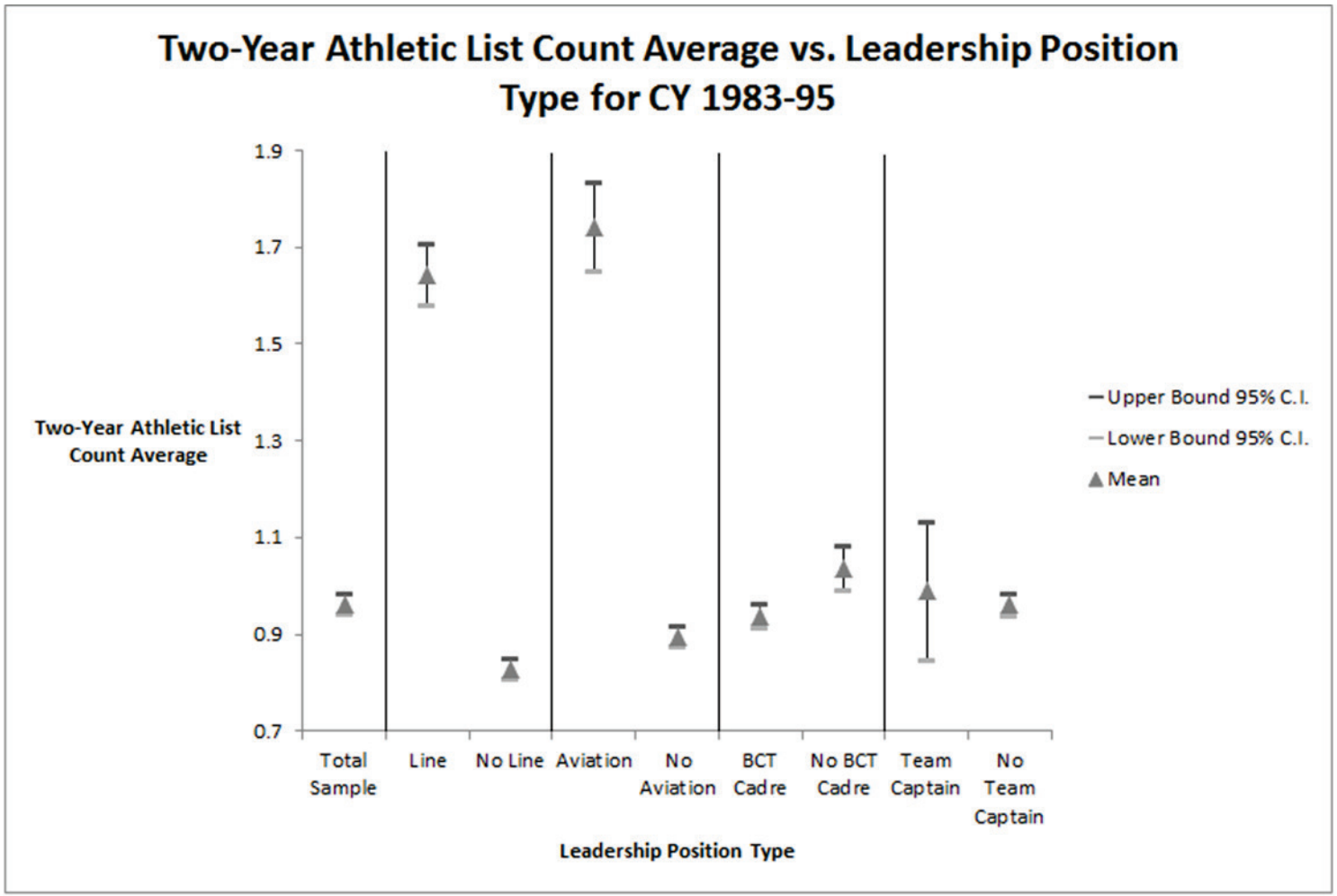


Figure B.4
Two-Year MPA vs. Leadership Position Type for CY 1985-95

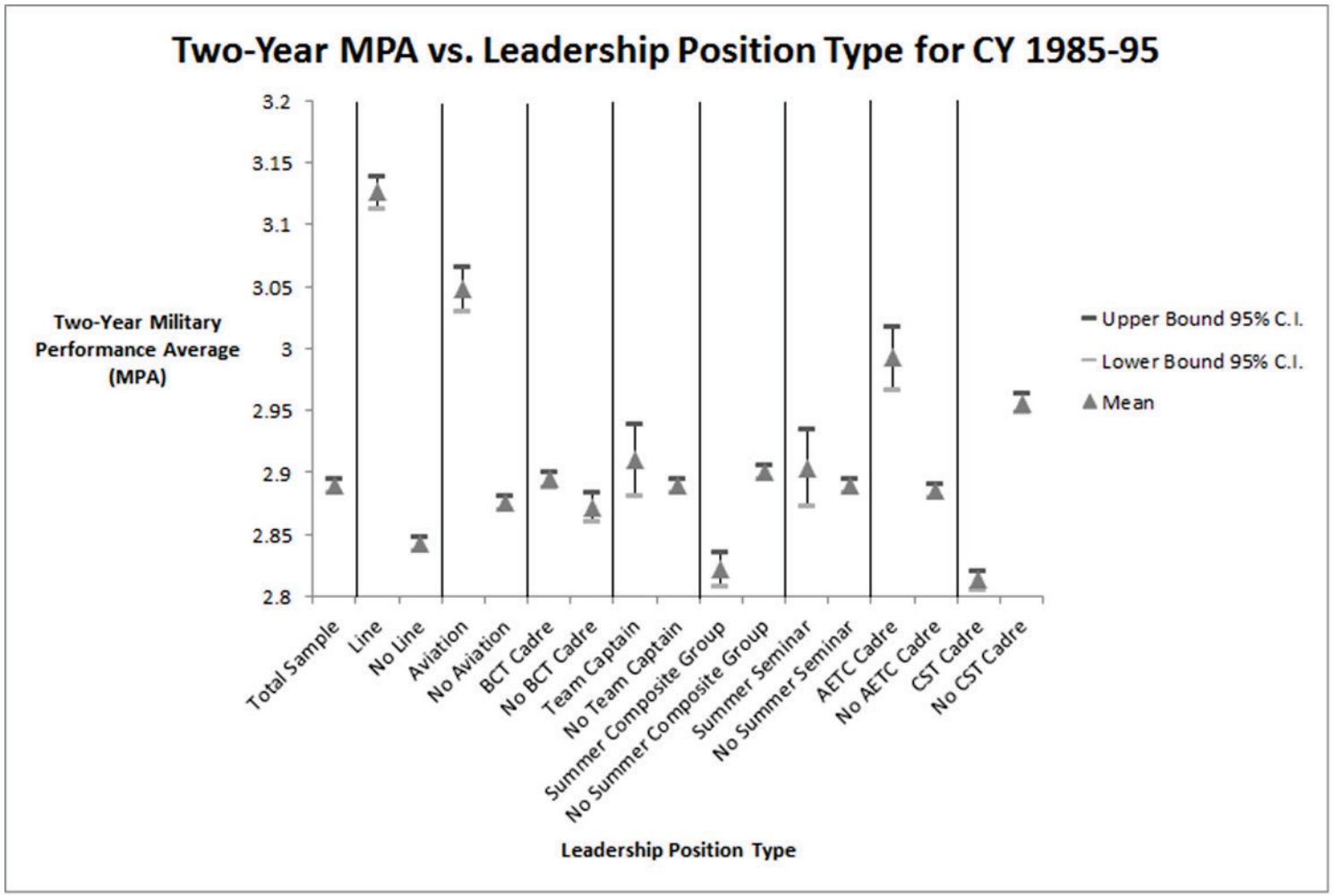


Figure B.5
Two-Year GPA vs. Leadership Position Type for CY 1985-95

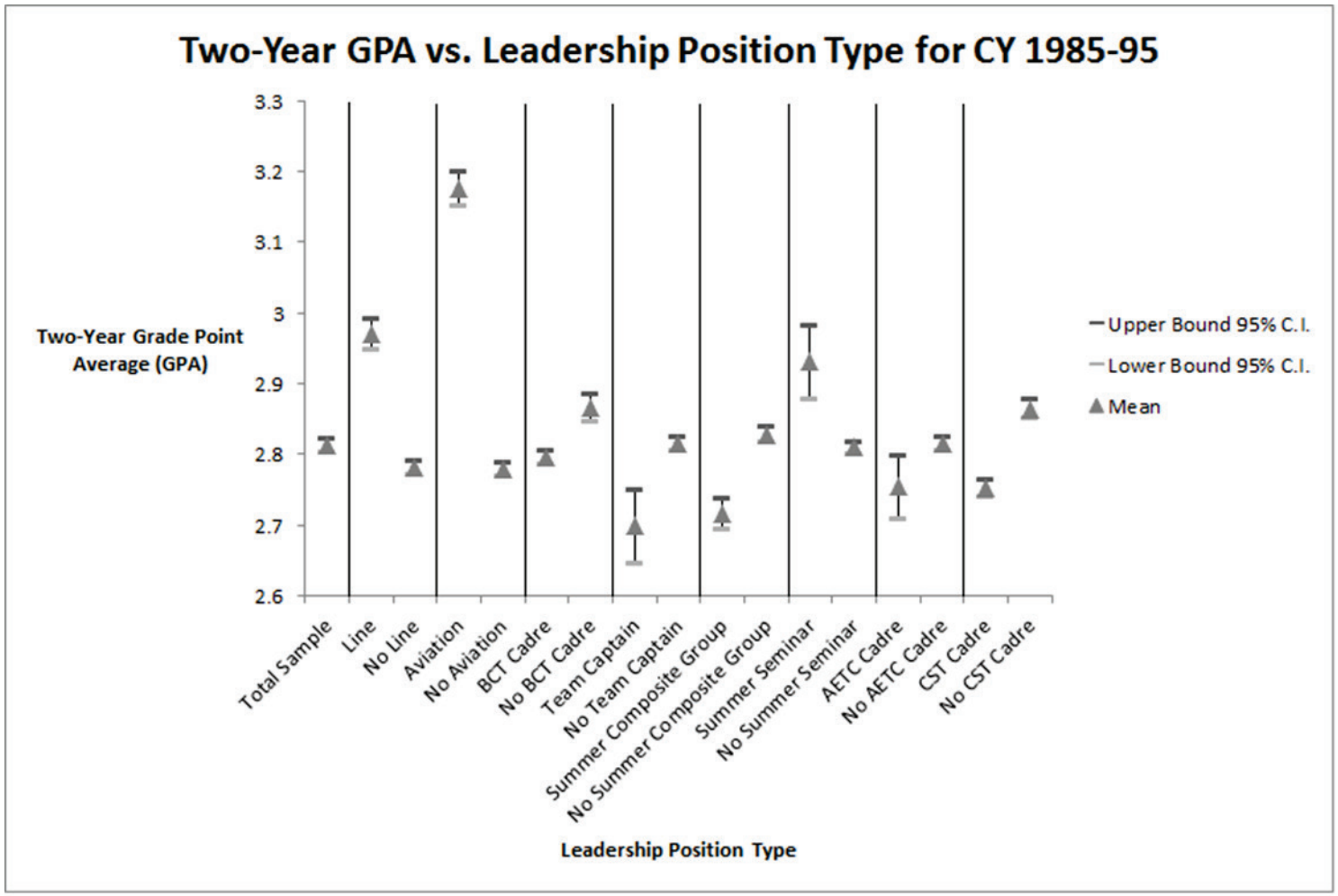


Figure B.6
Two-Year GPA vs. Leadership Position Type for CY 1985-95

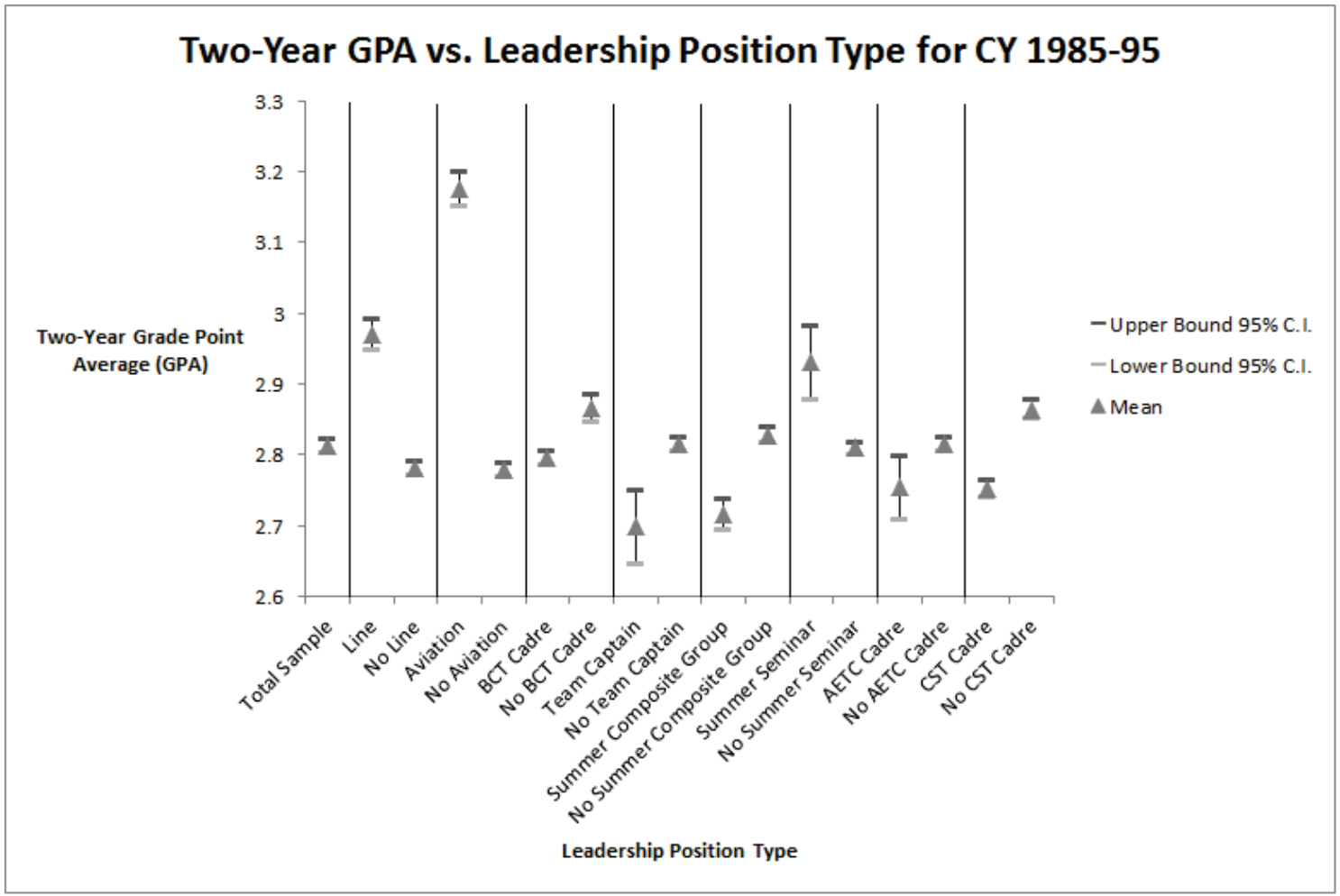


Figure B.7
Two-Year MPA vs. Leadership Position Type for CY 1983-88

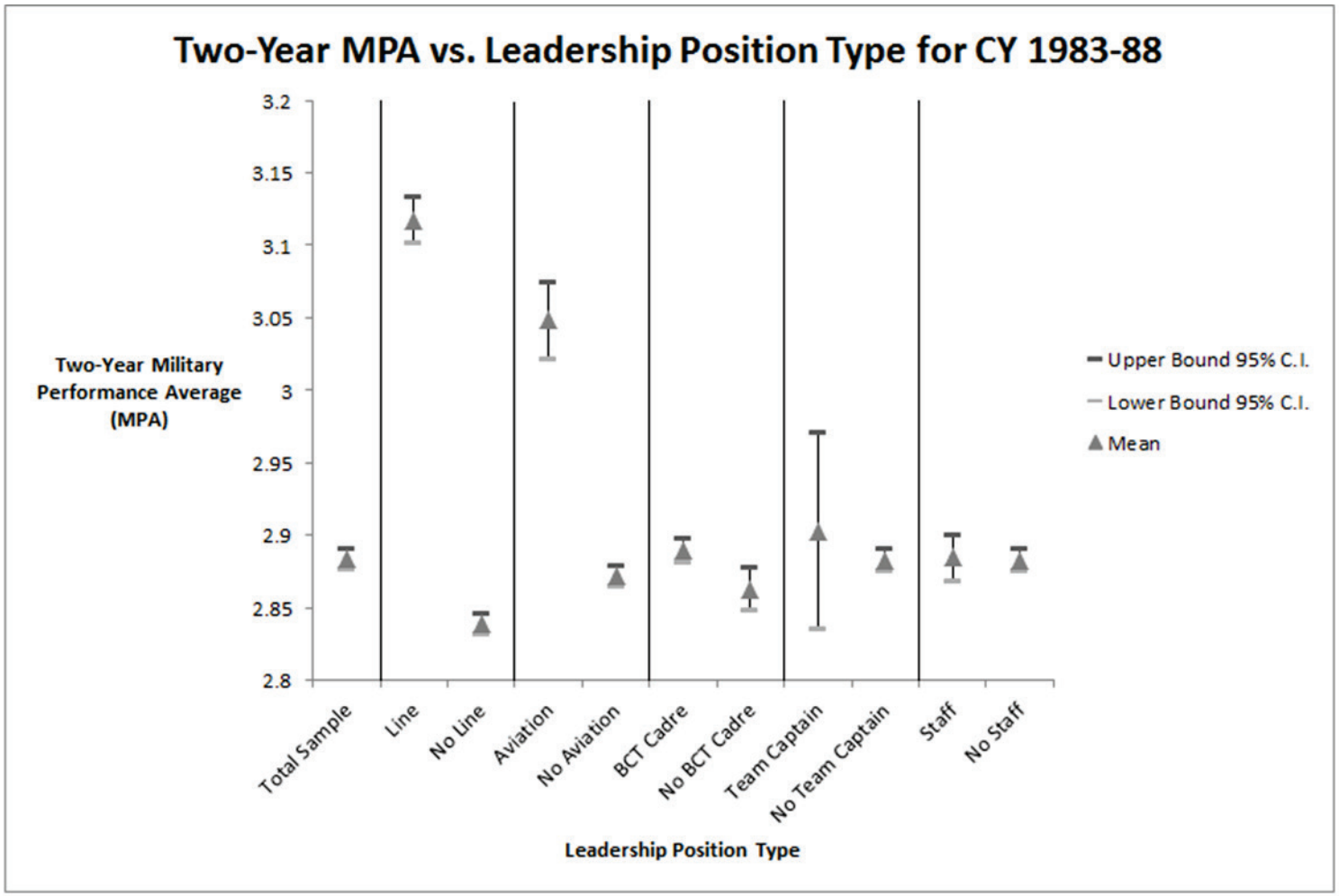


Figure B.8
Two-Year GPA vs. Leadership Position Type for CY 1983-88

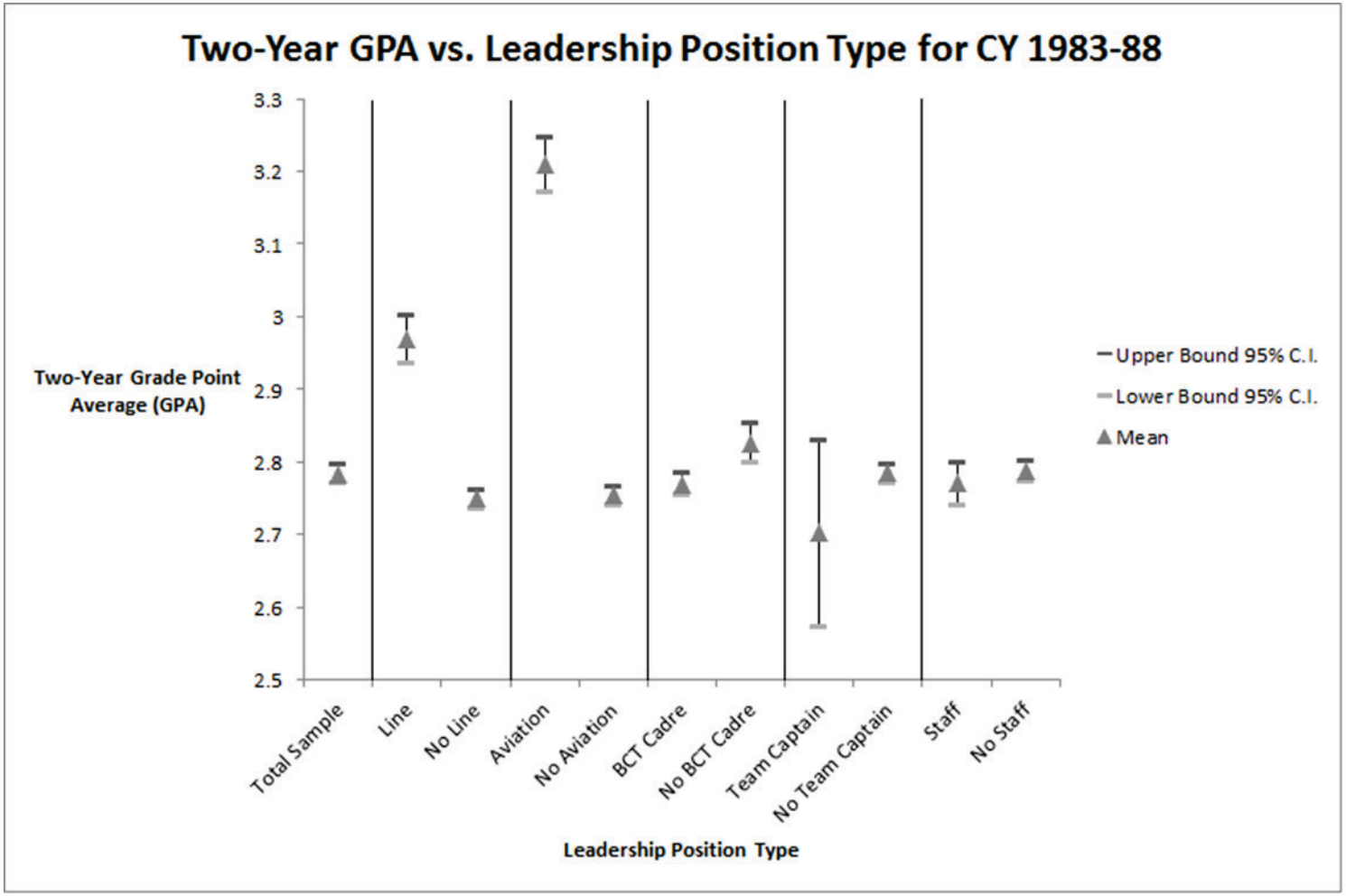


Figure B.9
Two-Year Athletic List Count Average vs. Leadership Position Type for CY 1983-88

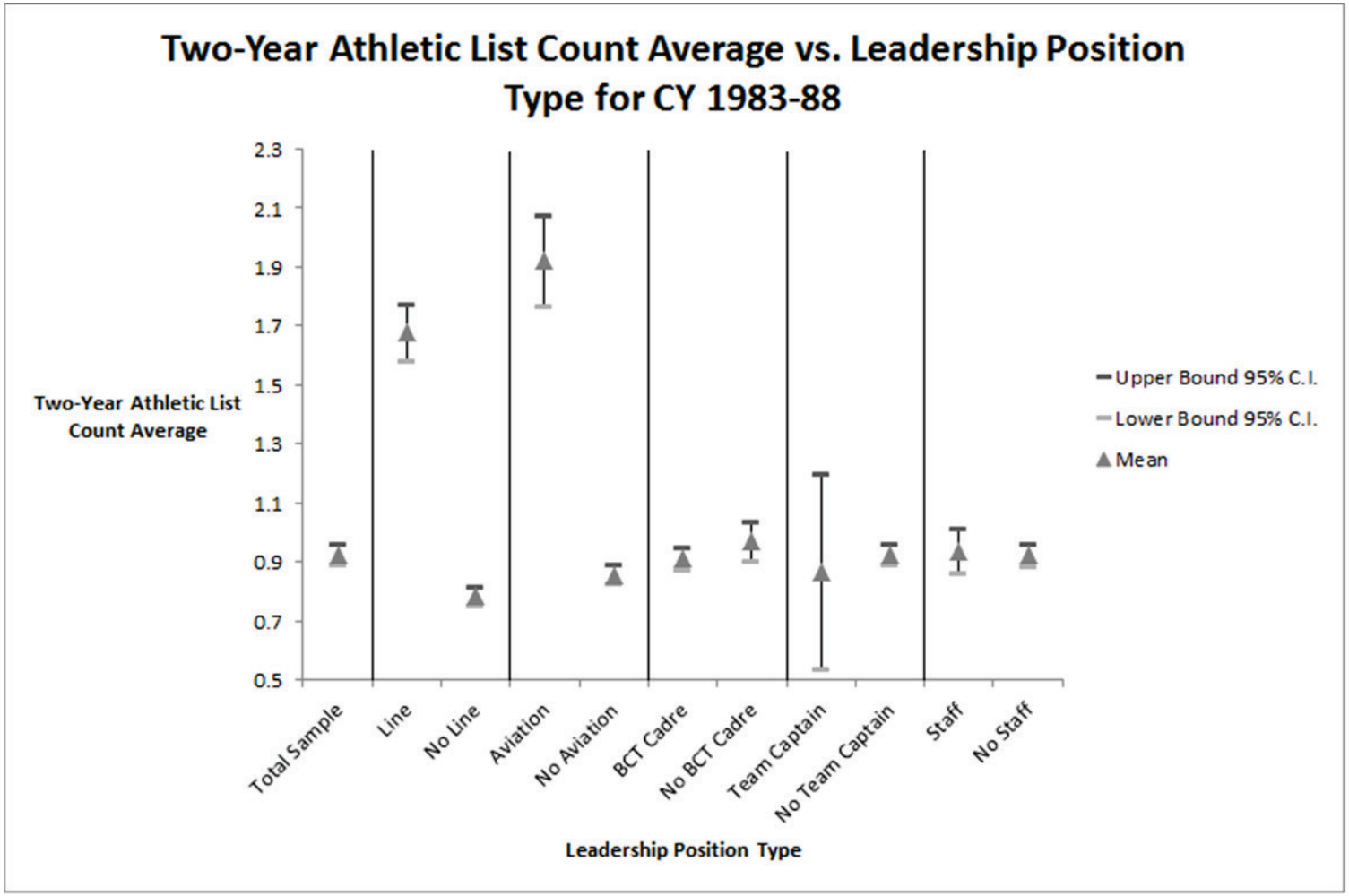


Figure B.10
Two-Year MPA vs. Leadership Position Type for CY 1989-91

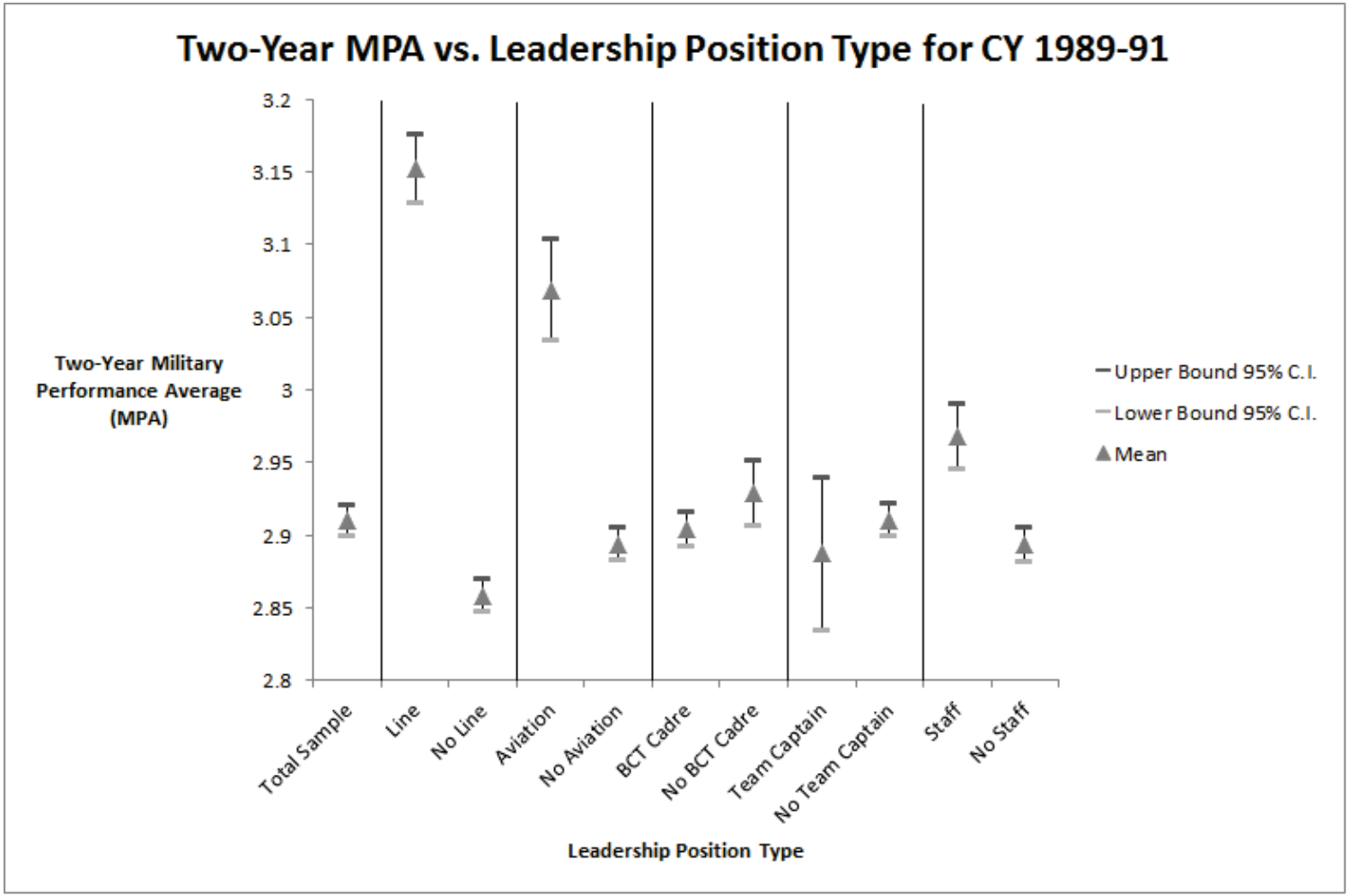


Figure B.11
Two-Year GPA vs. Leadership Position Type for CY 1989-91

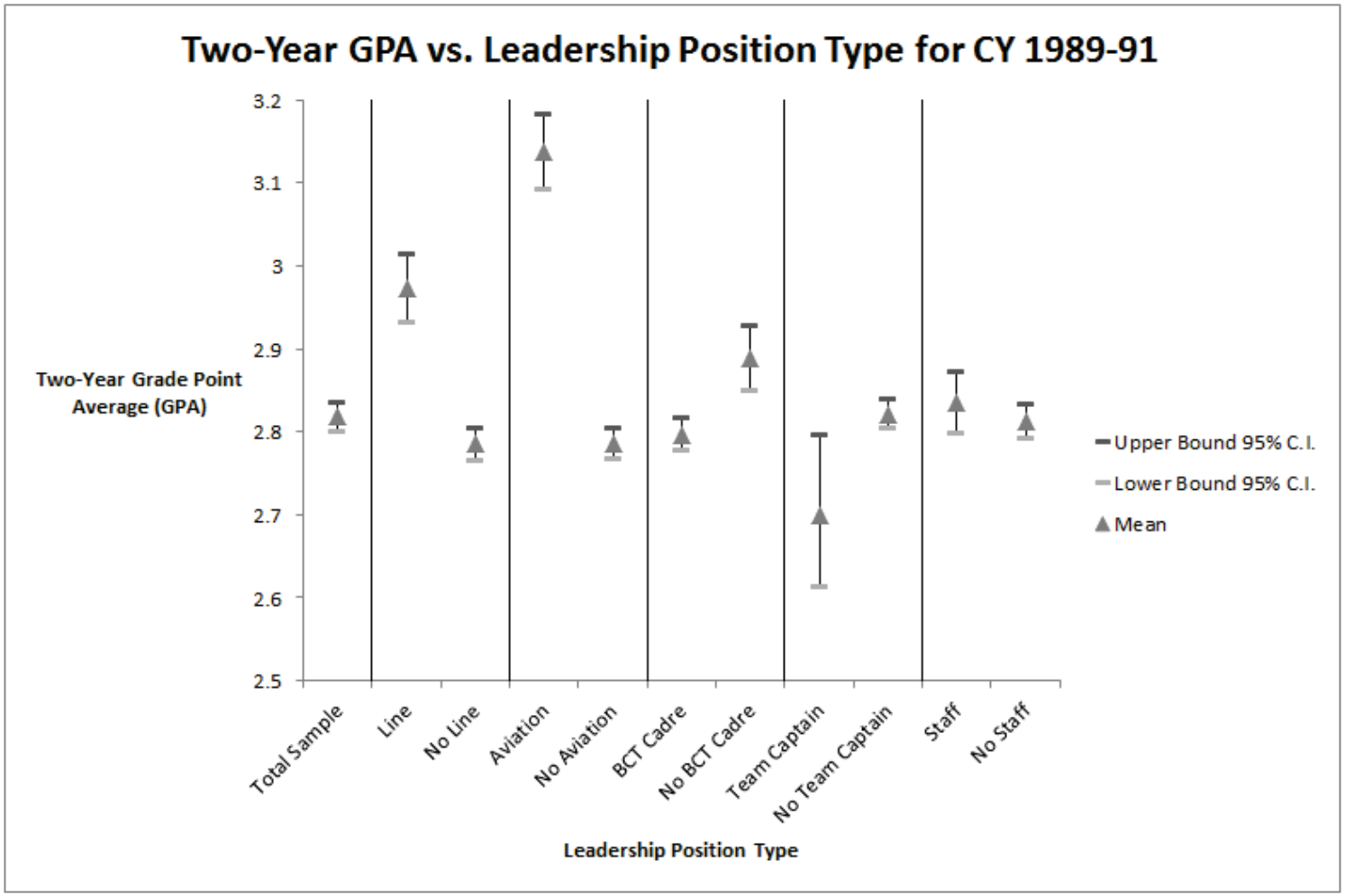
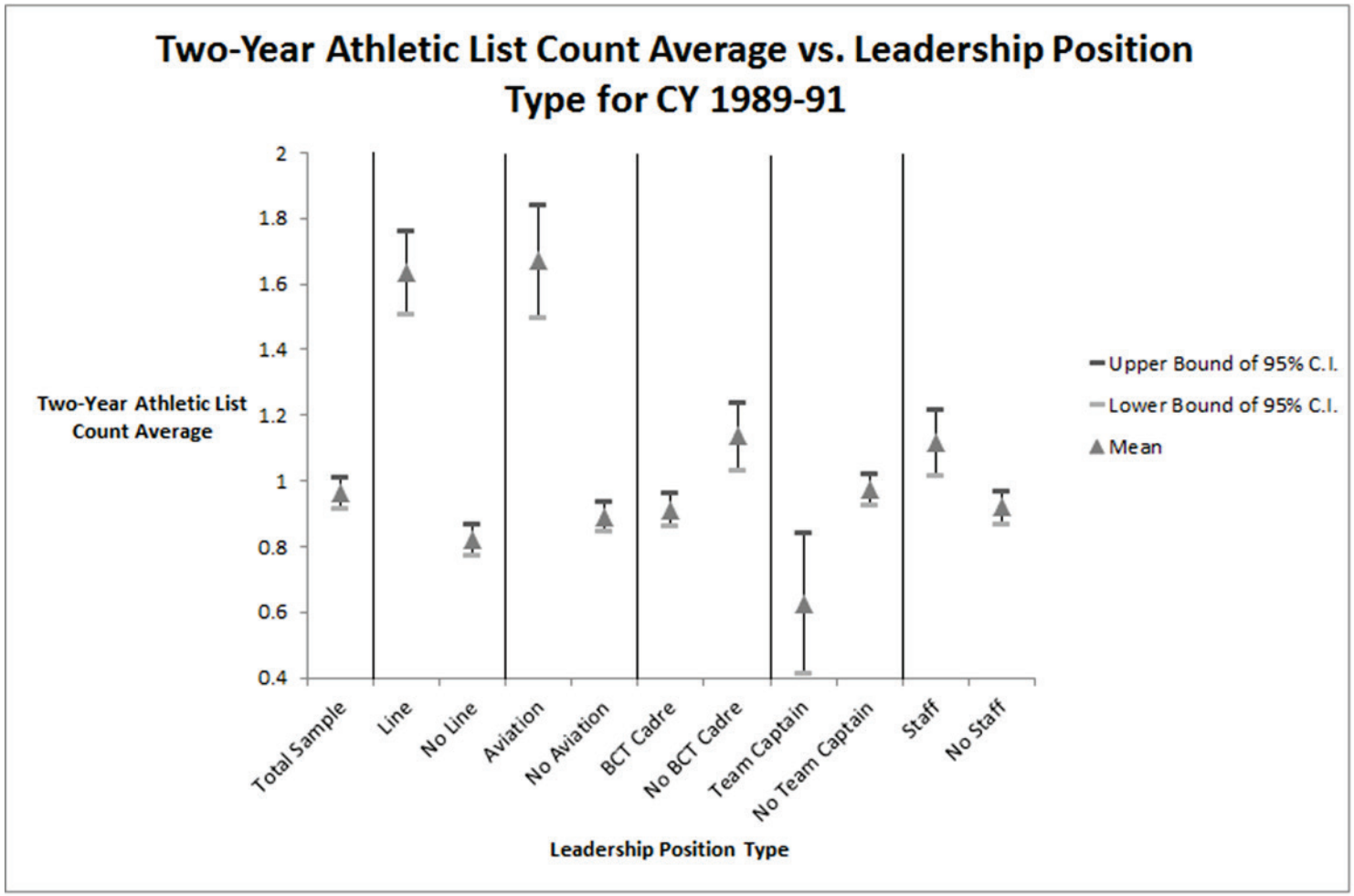


Figure B.12
Two-Year Athletic List Count Average vs. Leadership Position Type for CY 1989-91



APPENDIX C
CORRELATION MATRICES FOR RESEARCH QUESTION 2

Four correlation matrices corresponding to the four logistic regression models presented in the Research Question 2 section of the Results Chapter are shown in this appendix. Each of the correlation matrices includes raw correlations between the variables used in the corresponding model including leadership position indicators, covariates, and the promotion indicator.

Table C.1
Correlations Among Predictors and Lieutenant Colonel Indicator (Class Years 1983-1995)

	LL	AL	BC	TC	GR	Con	PAR	GPA	MPA	AMC
Leadership Positions										
Line Leader (LL)										
Aviation Leader (AL)	.08**									
BCT Cadre (BC)	.02**	-.34**								
Team Captain (TC)	-.02*	-.04**	.02							
Covariates										
Gender (GR)	.06**	.07**	-.05**	-.08**						
ACT/SAT Con (Con)	.03**	.12**	-.05**	-.09**	.05**					
PAR	.08**	.08**	-.02*	-.03**	-.12**	.27**				
2-YR GPA (GPA)	.16**	.23**	-.08**	-.03**	.06**	.44**	.46**			
2-YR MPA (MPA)	.38**	.17**	.01	.01	.01	.13**	.25**	.42**		
2-YR AMC (AMC)	.24**	.18**	-.04**	.00	.00	.23**	.30**	.60**	.60**	
Lead Comp (LC)	.07**	.04**	-.01	.06**	-.05**	-.09**	.06**	.01	.14**	.07**
Sel Panel Rtg (SP)	.02	.02*	.06**	.02*	-.03**	-.12**	-.08**	-.04**	-.01	-.02
CFA	.02**	.01	.01	.05**	.02	-.15**	-.13**	-.01	.07**	.04**
Entry Age (EA)	.01	-.02	.00	.01	.06**	-.14**	-.11**	-.14**	.03**	-.03**
Prior ADR (ADR)	.02	-.02*	-.01	-.02*	.02*	-.07**	-.02	-.03**	.06**	.01
Acad Sib (AS)	.02*	-.02**	.02*	.02*	-.03**	-.02**	.00	.00	.00	.00
Acad Par (AP)	.01	.00	.02	.02**	.00	.01	-.02*	.01	.01	.00
Military Parent (MP)	.02*	.00	.01	.00	-.01	.03**	-.01	-.02**	.03**	-.02*
Prep School (PS)	-.02**	-.04**	.00	.03**	.03**	-.16**	-.13**	-.25**	-.05**	-.12**
Outcome										
Lieutenant Colonel (LC)	.10**	.03**	-.01	.00	.09**	.07**	.07**	.10**	.15**	.10**

NOTE: *p <.05, **p<.01

Table C.1-Continued

	LC	SP	CFA	EA	ADR	AS	AP	MP	PS
Covariates									
Sel Panel Rtg (SP)	.11*								
CFA	.31**	.05**							
Entry Age (EA)	.08**	-.01	.10**						
Prior ADR (ADR)	-.02**	-.04**	-.04**	.46**					
Acad Sib (AS)	.05**	.04**	.05**	-.01	-.04**				
Acad Par (AP)	.01	.04**	.00	.00	-.02*	.06**			
Military Parent (MP)	.00	.00	-.03**	-.03**	-.05**	.07**	.24**		
Prep School (PS)	.02	-.05**	.11**	.49**	.24**	.02**	.01	.01	
Outcome									
Lieutenant Colonel (LC)	.03**	-.01	-.03**	-.01	.00	.00	.02*	.04**	-.01

NOTE: *p <.05, **p<.01

Correlations involving at least one dichotomous variable are limited by the variable distribution. Therefore, interpreting such correlations using standard rules of thumb for magnitude is not recommended. It is possible to adjust the correlation coefficient to account for this limitation by dividing the coefficient by the maximum possible value (Davenport Jr. and El-Sanhurry, 1991, p. 821). For example, the maximum value for the correlation between Prior Service Active Duty Regular and Prep School is .38. Dividing the original correlation of .24 by this maximum value yields a magnitude of .63.

Table C.2
Correlations Among Predictors and Lieutenant Colonel Indicator (Class Years 1985-1995)

	LL	AL	BC	TC	AE	CS	SS	CG	GR	Con
Leadership Positions										
Line Leader (LL)										
Aviation Leader (AL)	.08**									
BCT Cadre (BC)	.04**	-.40**								
Team Captain (TC)	-.02*	.05**	.01							
AETC (AE)	.05**	-.05**	-.01	.00						
CST (CS)	-.12**	-.25**	-.21**	-.02*	-.11**					
Summer Seminar (SS)	-.01	-.05**	.00	-.02*	-.01	-.04**				
Comp Group (CG)	-.06**	-.09**	-.03**	-.02	-.01	-.07**	-.04**			
Covariates										
Gender (GR)	.06**	.07**	-.05**	-.09**	.00	.04**	-.07**	.00		
ACT/SAT Con (Con)	.03**	.12**	-.04**	-.10**	-.04**	-.02	.05**	-.03**	.05**	
PAR	.07**	.08**	-.02	-.04**	.01	-.05**	.05**	-.03**	-.13**	.27**
2-YR GPA (GPA)	.15**	.23**	-.06**	-.04**	-.02*	-.12**	.04**	-.08**	.06**	.44**
2-YR MPA (MPA)	.37**	.17**	.03**	.01	.07**	-.25**	.01	-.10**	.01	.13**
2-YR AMC (AMC)	.24**	.18**	-.02	.00	.00	-.16**	.01	-.07**	.01	.22**
Lead Comp (LC)	.07**	.02*	-.03**	.05**	.01	-.03**	.00	-.01	-.04**	-.09**
Sel Panel Rtg (SP)	.04**	-.01	-.03**	.00	.00	-.02	-.02*	-.01	-.04**	-.11**
CFA	.02*	.01	.01	.06**	-.02	-.05**	-.03**	-.01	.02*	-.15**
Entry Age (EA)	.02	-.01	-.01	.01	.12**	-.01	-.02*	.02	.06**	-.14**
Prior ADR (ADR)	.02*	-.01	-.01	-.02	.23**	-.04**	-.01	.00	.02	-.07**
Acad Sib (AS)	.02	-.02*	.03**	.02*	-.01	-.02*	-.01	-.01	-.03**	-.04**
Acad Par (AP)	.01	.00	.01	.02*	.01	.00	-.01	.01	.00	.00
Military Parent (MP)	.02*	.00	.01	.00	.01	.00	-.01	.01	-.02	.04**
Prep School (PS)	-.02*	-.04**	.00	.03**	.09**	.03**	-.04**	.01	.03**	-.18**
Outcome										
Lieutenant Colonel (LC)	.10**	.04**	-.01	.00	.02*	-.04**	.00	-.02*	.10**	.07**

NOTE: *p < .05, **p<.01

Table C.2-Continued

	PAR	GPA	MPA	AMC	LC	SP	CFA	EA	ADR	AS	AP	MP	PS
Covariates													
2-YR GPA (GPA)	.45**												
2-YR MPA (MPA)	.25**	.42**											
2-YR AMC (AMC)	.30**	.59**	.59**										
Lead Comp (LC)	.07**	.02*	.15**	.08**									
Sel Panel Rtg (SP)	-.11**	-.04**	.01	.00	.09**								
CFA	-.11**	.01	.07**	.06**	.29**	.13**							
Entry Age (EA)	-.08**	-.12**	.03**	-.02*	.08**	-.01	.09**						
Prior ADR (ADR)	.01	-.02*	.07**	.01	.01	-.02*	-.05**	.45**					
Acad Sib (AS)	.00	.00	.00	.00	.05**	.08**	.04**	.00	-.03**				
Acad Par (AP)	-.03**	.00	.01	.00	.01	.05**	.01	.01	-.02*	.06**			
Military Parent (MP)	.00	-.02*	.03**	-.02	-.01	-.04**	-.04**	-.03**	-.05**	.06**	.24**		
Prep School (PS)	-.11**	-.25**	-.06**	-.12**	.01	-.04**	.08**	.49**	.23**	.02*	.01	.00	
Outcome													
Lieutenant Colonel (LC)	.06**	.08**	.15**	.10**	.03**	-.01	-.02*	-.01	.00	.00	.02	.04**	-.01

NOTE: *$p < .05$, **$p < .01$

Table C.3
Correlations Among Predictors and Lieutenant Colonel Indicator (Class Years 1983-1988)

	LL	SL	AL	BC	TC	GR	Con	PAR	GPA	MPA
Leadership Positions										
Line Leader (LL)										
Staff Leader (SL)	-.10**									
Aviation Leader (AL)	.05**	.02								
BCT Cadre (BC)	.03*	-.02	-.27**							
Team Captain (TC)	-.01	.03*	-.03*	.01						
Covariates										
Gender (GR)	.05**	.03*	.06**	-.04**	-.06**					
ACT/SAT Con (Con)	.01	-.03	.12**	-.03*	-.06**	.04**				
PAR	.08**	.00	.07**	.00	-.03	-.13**	.25**			
2-YR GPA Cum (GPA)	.16**	-.01	.23**	-.05**	-.02	.06**	.44**	.47**		
2-YR MPA (MPA)	.37**	.00	.16**	.04**	.01	.01	.13**	.26**	.43**	
2-YR AMC (AMC)	.26**	.00	.21**	-.02	-.01	.00	.27**	.34**	.66**	.63**
Lead Comp (LC)	.10**	.02	.05**	.00	.03*	-.05**	-.15**	-.04**	-.05**	.14**
Sel Panel Rtg (SP)	-.02	.02	.01	.14**	.05**	.00	-.22**	-.14**	-.11**	-.07**
CFA	.05**	.03*	.01	.00	.03*	.02	-.14**	-.13**	-.06**	.07**
Entry Age (EA)	.01	-.02	-.02	-.03*	.00	.05**	-.12**	-.16**	-.16**	.05**
Prior ADR (ADR)	.01	.00	-.02	-.02	-.02	.02	-.07**	-.04**	-.04**	.07**
Acad Sib (AS)	.01	.01	-.02	.02	.05**	-.04**	.00	.02	-.01	.00
Acad Par (AP)	-.10	-.01	-.01	.01	.00	.00	.02	-.02	.01	.00
Military Parent (MP)	.02	.01	-.04**	.00	.02	-.03*	-.03*	-.06**	-.07**	.02
Prep School (PS)	-.03*	.00	-.04**	-.01	.03*	.04**	-.08*	-.17**	-.24**	-.02
Outcome										
Lieutenant Colonel (LC)	.09**	.03*	.01	.02	.00	.08**	.06**	.07**	.12**	.13**

NOTE: *p <.05, **p<.01

Table C.3-Continued

	AMC	LC	SP	CFA	EA	ADR	AS	AP	MP	PS
Lead Comp (LC)	.03*									
Sel Panel Rtg (SP)	-.07**	.05*								
CFA	.01	.57**	.03							
Entry Age (EA)	-.05**	.09**	-.05**	.12**						
Prior ADR (ADR)	.00	-.07**	-.07**	-.03*	.47**					
Acad Sib (AS)	.00	.06**	-.01	.04**	-.01	-.04**				
Acad Par (AP)	.00	-.01	-.01	-.01	-.01	-.02	.03*			
Military Parent (MP)	-.03*	-.04**	.02	.02	.00	-.03**	.11**	.23**		
Prep School (PS)	-.14**	.06**	-.13**	.14**	.49**	.27**	.02	.01	.07**	
Lieutenant Colonel (LC)	.11**	.01	-.04**	-.04**	-.02	-.01	.02	.01	.02	.00

NOTE: *p <.05, **p<.01

Table C.4
Correlations Among Predictors and Lieutenant Colonel Indicator (Class Years 1989-1991)

	LL	SL	AL	BC	TC	GR	Con	PAR	GPA	MPA
Leadership Positions										
Line Leader (LL)										
Staff Leader (SL)	-.05**									
Aviation Leader (AL)	.09**	.01								
BCT Cadre (BC)	.01	.00	-.40**							
Team Captain (TC)	-.03	-.05**	-.06**	.03						
Covariates										
Gender (GR)	.07**	-.03	.08**	-.08**	-.08**					
ACT/SAT Con (Con)	.03	.03	.10**	-.04*	-.10**	.05*				
PAR	.07**	.03	.06**	-.01	-.03	-.13**	.21**			
2-YR GPA Cum (GPA)	.15**	.02	.21**	-.08**	-.04*	.06**	.45**	.43**		
2-YR MPA (MPA)	.39**	.11**	.18**	-.04	-.01	.00	.12**	.25**	.40**	
2-YR AMC (AMC)	.25**	.07**	.18**	-.08**	-.05*	.01	.27**	.33**	.63**	.61**
Lead Comp (LC)	.05**	.00	-.03	.00	.07**	-.05*	-.17**	.06**	.01	.18**
Sel Panel Rtg (SP)	.02	.01	.00	.00	.03	-.04*	-.08**	-.08**	-.02	.04*
CFA	-.01	-.06**	.01	.01	.07**	.04*	-.16**	-.08**	.01	.04*
Entry Age (EA)	.03	-.01	-.02	.04*	.02	.07**	-.15**	-.04	-.11**	.04
Prior ADR (ADR)	.06**	.03	-.03	.00	-.01	.02	-.08**	.04	-.02	.10**
Acad Sib (AS)	.00	-.03	-.04*	.02	.01	-.02	-.02	-.01	.00	.02
Acad Par (AP)	.03	.04	-.02	.04*	.05**	-.01	-.01	-.08**	-.03	.00
Military Parent (MP)	.00	.02	.05*	.00	-.03	.01	.05**	-.02	.00	.00
Prep School (PS)	-.01	-.03	-.04*	.03	.03	.01	-.24**	-.04	-.26**	-.06**
Outcome										
Lieutenant Colonel (LC)	.11**	.02	.01	-.01	.01	.09**	.07**	.05*	.06**	.15**

NOTE: *p <.05, **p<.01

Table C.4-Continued

	AMC	LC	SP	CFA	EA	ADR	AS	AP	MP	PS
Covariates										
Lead Comp (LC)	.09**									
Sel Panel Rtg (SP)	-.01	.19**								
CFA	.01	.42**	.15**							
Entry Age (EA)	-.03	.10**	.11**	.06**						
Prior ADR (ADR)	.04*	.06**	.01	-.07**	.47**					
Acad Sib (AS)	-.01	.06**	.11**	.05*	-.01	-.04*				
Acad Par (AP)	-.02	-.01	.08**	.01	.02	-.03	.07**			
Military Parent (MP)	.00	-.03	.00	-.04*	-.07**	-.07**	.05**	.21**		
Prep School (PS)	-.14**	-.01	.14**	.05**	.52**	.25**	.03	.04*	-.03	
Outcome										
Lieutenant Colonel (LC)	.09**	.01	.00	-.01	.02	.04*	-.01	.00	.04*	.02

NOTE: *p <.05, **p<.01

Appendix D: Comparisons Of Means and Variances After Propensity Weighting For Line or No Line Position: Models 2-4 Samples

This appendix displays mean and variance comparisons between the group of individuals holding line positions and those individuals not holding line positions after propensity weighting for the Models 2-4 samples. The tables in this appendix inform the results presented in the "Research Question 2" section of the "Results and Discussion" chapter. Table D.1 shows a comparison of means between the line and no line groups before and after propensity weighting for the Model 2 sample. Table D.2 shows a comparison of standard deviations between the line and no line groups before and after propensity weighting for the Model 2 sample. Table D.3 shows a comparison of means between the line and no line groups before and after propensity weighting for the Model 3 sample. Table D.4 shows a comparison of standard deviations between the line and no line groups before and after propensity weighting for the Model 3 sample. Table D.5 shows a comparison of means between the line and no line groups before and after propensity weighting for the Model 4 sample. Table D.6 shows a comparison of standard deviations between the line and no line groups before and after propensity weighting for the Model 4 sample.

Table D.1
Comparison of Means Between the Line and No Line Groups Before and After Propensity Weighting for the Model 2 Sample

Variable	No Line Position Mean[b]	Line Position Mean[b]	*p*-value[a]	No Line Position Mean (weighted)[b]	*p*-value[a]
Leadership Positions					
Aviation Leader	7.3%	13.5%	.000**	13.8%	.722
BCT Cadre	75.9%	80.2%	.000**	79.5%	.527
Team Captain	2.9%	1.8%	.016*	1.8%	.895
Summer Composite	15.0%	9.1%	.000**	9.2%	.896
Summer Seminar	2.6%	2.1%	.212	2.0%	.835
AETC	3.3%	5.7%	.000**	5.6%	.859
CST	49.1%	33.6%	.000**	33.6%	.994
Demographic Covariates					
Male	87.7%	93.0%	.000**	93.2%	.753
Caucasian	84.9%	87.2%	.011*	87.5%	.762
Black	6.7%	5.5%	.068	5.1%	.495
Hispanic	4.7%	3.8%	.099	3.5%	.540
Asian	3.2%	2.9%	.461	3.4%	.290
Other Race	.6%	.6%	.804	.6%	.734
Northeast	17.2%	15.2%	.049*	15.5%	.741
Midwest	25.3%	24.6%	.591	24.6%	.977
South	31.7%	33.7%	.109	33.5%	.909
West	23.8%	24.3%	.621	24.4%	.991
Other Region	2.1%	2.1%	.946	2.0%	.676
Year Group 85-86	18.0%	17.2%	.475	16.6%	.527
Year Group 87-89	27.1%	27.5%	.739	27.4%	.907
Year Group 90-92	28.0%	28.2%	.922	28.2%	.954
Year Group 93-95	26.9%	27.1%	.855	27.8%	.557

Table D.1-Continued

Variable	No Line Position Mean[b]	Line Position Mean[b]	*p*-value[a]	No Line Position Mean (weighted)[b]	*p*-value[a]
Rated	43.1%	54.6%	.000**	54.4%	.857
Nonrated Ops	10.9%	7.6%	.000**	7.4%	.762
Mission Support	10.9%	7.6%	.000**	7.4%	.762
Entry Age	18.0	18.1	.062	18.1	.714
Prior ADR	2.3%	3.3%	.016*	3.3%	.988
Prep School	17.0%	14.7%	.021*	14.5%	.801
Acad Sib	8.7%	10.1%	.082	9.3%	.305
Acad Par	2.9%	3.5%	.177	3.5%	.904
Mil Par	34.1%	36.7%	.034*	36.4%	.817
Application Covariates					
ACT/SAT Concor	1306.9	1313.6	.009**	1317.7	.105
PAR	641.9	658.6	.000**	660.8	.337
Lead Comp	1679.7	1713.6	.000**	1713.4	.970
CFA	504.0	509.0	.033*	508.6	.887
Sel Panel Rtg	602.9	608.9	.000**	608.3	.698
Academy Covariates					
2-YR GPA	2.78	2.97	.000**	2.98	.288
2-YR MPA	2.84	3.13	.000**	3.14	.152
2-YR Ath List	.84	1.62	.000**	1.67	.194

NOTE: The * symbol signifies a statistically significant difference in means between the individuals in the no line position group and the line position group for that variable, *$p<.05$, **$p<.01$

[a] *p*-values are from a two-tailed *t*-test comparing the mean for the no line group to the mean for the line group

[b] Dichotomous variables are presented as percentages of the sample by line and no line groups. Continuous variables are presented with means for the line and no line groups.

Table D.2
Comparison of Standard Deviations Between the Line and No Line Groups Before and After Propensity Weighting for the Model 2 Sample

Variable	No Line Position SD	Line Position SD	*p*-value[a]	No Line Position SD (weighted)	*p*-value[a]
Leadership Positions					
Aviation Leader	.261	.341	.000**	.345	.608
BCT Cadre	.428	.399	.000**	.404	.518
Team Captain	.167	.134	.000**	.132	.487
Summer Composite	.357	.287	.000**	.288	.809
Summer Seminar	.160	.144	.000**	.141	.312
AETC	.178	.232	.000**	.230	.615
CST	.500	.473	.003**	.472	.986
Demographic Covariates					
Male	.329	.255	.000**	.252	.437
Caucasian	.359	.334	.000**	.331	.616
Black	.249	.227	.000**	.219	.052
Hispanic	.211	.190	.000**	.183	.031*
Asian	.177	.167	.004**	.181	.000**
Other Race	.077	.080	.027*	.076	.002**
Northeast	.377	.359	.011*	.362	.669
Midwest	.434	.431	.675	.431	.964
South	.465	.473	.391	.472	.939
West	.426	.429	.657	.429	.991
Other Region	.143	.144	.733	.139	.044*
Year Group 85-86	.384	.378	.400	.372	.418
Year Group 87-89	.445	.447	.794	.446	.917
Year Group 90-92	.449	.450	.929	.450	.985

Table D.2-Continued

Variable	No Line Position SD	Line Position SD	*p*-value[a]	No Line Position SD (weighted)	*p*-value[a]
Year Group 93-95	.443	.445	.877	.448	.690
Rated	.495	.498	.764	.498	.998
Nonrated Ops	.312	.265	.000**	.261	.476
Mission Support	.498	.485	.153	.486	.920
Entry Age	.808	.836	.065	.865	.077
Prior ADR	.150	.178	.000**	.179	.971
Prep School	.375	.354	.002**	.352	.705
Acad Sib	.282	.301	.001**	.290	.046*
Acad Par	.167	.183	.000**	.184	.680
Mil Par	.474	.482	.350	.481	.911
Application Covariates					
ACT/SAT Concor	96.2	91.4	.007**	96.2	.007**
PAR	87.8	85.4	.148	88.5	.067
Lead Comp	183.6	179.8	.278	188.7	.011*
CFA	87.4	87.4	.999	86.0	.394
Sel Panel Rtg	62.8	60.3	.034*	58.5	.117
Academy Covariates					
2-YR GPA	.467	.465	.815	.496	.001**
2-YR MPA	.259	.270	.021*	.291	.000**
2-YR Ath List	1.15	1.43	.000**	1.51	.005**

NOTE: The * symbol signifies a statistically significant standard deviation difference between the individuals in the no line position group and the line position group for that variable, *$p<.05$, **$p<.01$

[a] *p*-values are from a two-tailed ratio f-test comparing the unweighted (column 4) and weighted (column 6) standard deviations for the no line group to the standard deviation for the line group.

Table D.3
Comparison of Means Between the Line and No Line Groups Before and After Propensity Weighting for the Model 3 Sample

Variable	No Line Position Mean[b]	Line Position Mean[b]	*p*-value[a]	No Line Position Mean (weighted)[b]	*p*-value[a]
Leadership Positions					
Aviation Leader	6.0%	9.4%	.000**	10.2%	.472
BCT Cadre	74.3%	77.8%	.029*	76.2%	.295
Team Captain	1.1%	.9%	.621	.8%	.872
Staff	21.0%	10.7%	.000**	10.9%	.824
Demographic Covariates					
Male	87.9%	92.4%	.000**	92.6%	.787
Caucasian	84.1%	89.1%	.000**	89.1%	.965
Black	7.3%	4.3%	.001**	3.8%	.476
Hispanic	4.7%	3.3%	.054	3.1%	.867
Asian	3.4%	2.6%	.189	3.3%	.276
Other Race	.5%	.8%	.265	.7%	.901
Northeast	19.9%	16.7%	.028*	17.4%	.613
Midwest	24.4%	23.4%	.518	22.9%	.705
South	27.8%	31.1%	.047*	31.3%	.864
West	25.4%	25.8%	.787	25.5%	.848
Other Region	2.5%	3.0%	.408	2.9%	.867
Year Group 83-84	34.3%	32.8%	.401	31.9%	.564
Year Group 85-86	32.6%	32.8%	.878	32.4%	.772
Year Group 87-88	33.1%	34.3%	.489	35.8%	.397
Rated	57.2%	66.0%	.000**	65.0%	.568
Nonrated Ops	8.9%	7.1%	.072	6.9%	.866
Mission Support	33.9%	26.9%	.000**	28.1%	.483
Entry Age	18.0	18.0	.672	18.0	.601

Table D.3-Continued

Variable	No Line Position Mean[b]	Line Position Mean[b]	*p*-value[a]	No Line Position Mean (weighted)[b]	*p*-value[a]
Prior ADR	3.2%	3.5%	.647	3.8%	.669
Prep School	15.1%	12.3%	.035*	12.4%	.955
Acad Sib	10.2%	11.4%	.267	11.4%	.998
Acad Par	1.6%	1.5%	.703	1.5%	.872
Mil Par	23.7%	26.1%	.115	27.6%	.359
Application Covariates					
ACT/SAT Concor	1294.5	1298.7	.270	1302.0	.370
PAR	624.2	644.5	.000**	647.1	.433
Lead Comp	1609.7	1653.9	.000**	1653.0	.895
CFA	520.9	531.9	.000**	532.9	.729
Sel Panel Rtg	591.7	587.5	.224	587.6	.983
Academy Covariates					
2-YR GPA	2.75	2.97	.000**	2.98	.615
2-YR MPA	2.84	3.12	.000**	3.13	.174
2-YR Ath List	.783	1.68	.000**	1.71	.570

NOTE: The * symbol signifies a statistically significant difference in means between the individuals in the no line position group and the line position group for that variable, *$p<.05$, **$p<.01$

[a] *p*-values are from a two-tailed *t*-test comparing the mean for the no line group to the mean for the line group

[b] Dichotomous variables are presented as percentages of the sample by line and no line groups. Continuous variables are presented with means for the line and no line groups.

Table D.4
Comparison of Standard Deviations Between the Line and No Line Groups Before and After Propensity Weighting for the Model 3 Sample

Variable	No Line Position SD	Line Position SD	*p*-value[a]	No Line Position SD (weighted)	*p*-value[a]
Leadership Positions					
Aviation Leader	.237	.292	.000**	.303	.177
BCT Cadre	.437	.416	.062	.426	.356
Team Captain	.103	.094	.001**	.091	.219
Staff	.407	.309	.000**	.312	.713
Demographic Covariates					
Male	.327	.266	.000**	.261	.519
Caucasian	.366	.311	.000**	.312	.961
Black	.260	.202	.000**	.190	.017*
Hispanic	.212	.177	.000**	.175	.511
Asian	.181	.159	.000**	.178	.000**
Other Race	.070	.088	.000**	.086	.306
Northeast	.399	.373	.011*	.379	.550
Midwest	.430	.424	.596	.420	.712
South	.448	.463	.197	.464	.945
West	.435	.438	.808	.436	.857
Other Region	.157	.171	.001**	.168	.493
Year Group 83-84	.475	.470	.701	.466	.736
Year Group 85-86	.469	.470	.913	.468	.856
Year Group 87-88	.471	.475	.714	.479	.729
Rated	.495	.474	.100	.477	.815
Nonrated Ops	.285	.256	.000**	.254	.667
Mission Support	.473	.444	.014*	.449	.637

Table D.4-Continued

Variable	No Line Position SD	Line Position SD	*p*-value[a]	No Line Position SD (weighted)	*p*-value[a]
Entry Age	.811	.809	.928	.852	.046*
Prior ADR	.175	.183	.088	.191	.140
Prep School	.358	.329	.002**	.330	.951
Acad Sib	.303	.318	.049*	.318	.999
Acad Par	.127	.120	.035*	.123	.376
Mil Par	.425	.440	.187	.447	.516
Application Covariates					
ACT/SAT Concor	103.5	98.4	.054	101.0	.310
PAR	88.8	87.5	.563	91.7	.076
Lead Comp	166.2	170.1	.361	163.7	.136
CFA	81.1	83.3	.291	81.8	.473
Sel Panel Rtg	94.5	93.8	.787	85.6	.000**
Academy Covariates					
2-YR GPA	.487	.495	.486	.525	.027*
2-YR MPA	.257	.245	.057	.269	.000**
2-YR Ath List	1.16	1.49	.000**	1.55	.153

NOTE: The * symbol signifies a statistically significant standard deviation difference between the individuals in the no line position group and the line position group for that variable, *p<.05, **p<.01

[a] p-values are from a two-tailed ratio f-test comparing the unweighted (column 4) and weighted (column 6) standard deviations for the no line group to the standard deviation for the line group.

Table D.5
Comparison of Means Between the Line and No Line Groups Before and After Propensity Weighting for the Model 4 Sample

Variable	No Line Position Mean[b]	Line Position Mean[b]	*p*-value[a]	No Line Position Mean (weighted)[b]	*p*-value[a]
Leadership Positions					
Aviation Leader	7.9%	15.1%	.000**	15.4%	.829
BCT Cadre	77.2%	77.9%	.734	76.9%	.635
Team Captain	3.3%	1.9%	.085	1.7%	.822
Staff	23.0%	17.1%	.004**	18.6%	.432
Demographic Covariates					
Male	87.4%	93.2%	.000**	93.6%	.718
Caucasian	87.5%	86.2%	.420	86.3%	.938
Black	6.0%	6.0%	.959	5.6%	.748
Hispanic	3.3%	3.9%	.531	3.4%	.574
Asian	2.6%	3.3%	.364	4.3%	.312
Other Race	.5%	.6%	.791	.4%	.431
Northeast	16.8%	15.7%	.552	15.5%	.933
Midwest	25.4%	24.9%	.827	25.5%	.789
South	32.4%	32.8%	.862	31.6%	.623
West	23.5%	24.7%	.549	25.9%	.608
Other Region	2.0%	1.9%	.885	1.4%	.505
Year Group 89	33.0%	33.4%	.874	32.7%	.765
Year Group 90-91	67.0%	66.6%	.874	67.3%	.765
Rated	42.8%	46.2%	.167	44.9%	.615
Nonrated Ops	13.4%	11.1%	.173	10.8%	.851
Mission Support	43.8%	42.7%	.649	44.2%	.534
Entry Age	18.0	18.1	.102	18.1	.882
Prior ADR	2.0%	4.3%	.003**	4.4%	.981

Table D.5-Continued

Variable	No Line Position Mean[b]	Line Position Mean[b]	*p*-value[a]	No Line Position Mean (weighted)[b]	*p*-value[a]
Prep School	15.6%	15.1%	.743	15.0%	.987
Acad Sib	8.4%	8.7%	.845	7.3%	.298
Acad Par	3.4%	4.9%	.097	5.5%	.631
Mil Par	47.3%	47.8%	.825	47.7%	.953
Application Covariates					
ACT/SAT Concor	1312.1	1320.0	.085	1325.6	.234
PAR	646.3	661.1	.001**	661.7	.890
Lead Comp	1670.6	1694.7	.008**	1687.2	.423
CFA	500.9	498.0	.507	495.7	.600
Sel Panel Rtg	582.7	586.1	.282	500.9	.507
Academy Covariates					
2-YR GPA	2.79	2.97	.000**	2.99	.418
2-YR MPA	2.86	3.15	.000**	3.17	.269
2-YR Ath List	.82	1.63	.000**	1.74	.172

NOTE: The * symbol signifies a statistically significant difference in means between the individuals in the no line position group and the line position group for that variable, *$p<.05$, **$p<.01$

[a] *p*-values are from a two-tailed *t*-test comparing the mean for the no line group to the mean for the line group

[b] Dichotomous variables are presented as percentages of the sample by line and no line groups. Continuous variables are presented with means for the line and no line groups.

Table D.6
Comparison of Standard Deviations Between the Line and No Line Groups Before and After Propensity Weighting for the Model 4 Sample

Variable	No Line Position SD	Line Position SD	*p*-value[a]	No Line Position SD (weighted)	*p*-value[a]
Leadership Positions					
Aviation Leader	.269	.358	.000**	.361	.797
BCT Cadre	.419	.415	.780	.421	.687
Team Captain	.180	.135	.000**	.130	.233
Staff	.421	.377	.003**	.389	.370
Demographic Covariates					
Male	.332	.252	.000**	.244	.353
Caucasian	.330	.345	.202	.344	.877
Black	.238	.237	.923	.230	.371
Hispanic	.180	.194	.027*	.181	.047*
Asian	.158	.179	.000**	.203	.001**
Other Race	.072	.078	.013*	.060	.000**
Northeast	.374	.364	.463	.362	.880
Midwest	.436	.433	.890	.436	.859
South	.468	.470	.897	.465	.762
West	.424	.432	.582	.438	.708
Other Region	.139	.135	.493	.119	.000**
Year Group 89	.470	.472	.906	.469	.849
Year Group 90-91	.470	.472	.906	.469	.849
Rated	.495	.499	.798	.498	.919
Nonrated Ops	.341	.315	.028*	.311	.713
Mission Support	.496	.495	.961	.497	.938
Entry Age	.806	.864	.046*	.903	.224

Table D.6-Continued

Variable	No Line Position SD	Line Position SD	*p*-value[a]	No Line Position SD (weighted)	*p*-value[a]
Prior ADR	.141	.204	.000**	.204	.971
Prep School	.363	.358	.683	.357	.951
Acad Sib	.277	.282	.653	.260	.021*
Acad Par	.181	.217	.000**	.228	.181
Mil Par	.499	.500	.957	.500	.966
Application Covariates					
ACT/SAT Concor	92.2	90.5	.604	93.7	.336
PAR	86.1	82.0	.172	85.5	.243
Lead Comp	182.2	178.6	.584	188.7	.127
CFA	89.3	85.2	.196	86.9	.577
Sel Panel Rtg	64.5	60.0	.047*	59.4	.757
Academy Covariates					
2-YR GPA	.471	.462	.581	.500	.028*
2-YR MPA	.263	.266	.759	.290	.020*
2-YR Ath List	1.15	1.42	.000**	1.56	.013*

NOTE: The * symbol signifies a statistically significant standard deviation difference between the individuals in the no line position group and the line position group for that variable, *$p<.05$, **$p<.01$

[a] *p*-values are from a two-tailed ratio f-test comparing the unweighted (column 4) and weighted (column 6) standard deviations for the no line group to the standard deviation for the line group.

APPENDIX E: POWER CALCULATION EXAMPLE

This appendix presents the formula used to calculate the sample sizes listed in Table 4.2.7 and provides an example calculation. The following equation is used to calculate the necessary sample size to detect an effect on a binary predictor in a logistic regression:

$$N = \frac{\left(z_{1-\alpha}\sqrt{p(1-p)/B} + z_{1-\beta}\sqrt{p_1(1-p_1) + p_2(1-p_2)(1-B)/B}\right)^2}{(p_1 - p_2)^2(1-B)(1-R^2)}$$

Where:

$N = desired\ sample\ size$

$z_{1-\alpha} = critical\ 1-tailed\ z\ value\ for\ 1-\alpha$

$p = average\ promotion\ probability\ for\ the\ sample$

$B = proportion\ of\ the\ sample\ holding\ the\ leadership\ position\ of\ interest$

$z_{1-\beta} = critical\ 1-tailed\ z\ value\ for\ 1-\beta$

$p_1 = average\ promotion\ probability\ if\ the\ leadership\ position\ of\ interest\ was\ not\ held$

$p_2 = average\ promotion\ probability\ if\ the\ leadership\ position\ of\ interest\ was\ held$

$R^2 = estimated\ correlation\ between\ the\ variable\ of\ interest\ and\ other\ covariates$

$\alpha = Type\ I\ error\ probability$

$\beta = Type\ II\ error\ probability$

Example calculation (sample size necessary to detect a 3% average marginal effect on promotion for holding a line position in the class years 1983-95 sample):

$N =$?

$z_{1-\alpha} = 1.645$

$p = .355$

$B = .164$

$z_{1-\beta} = .841$

$p_1 = .35$

$p_2 = .38/.40/45$ (3%, 5%, 10% average marginal effects)

$R^2 = .20$ (.20=small correlation, .40=medium, .60=large)

$\alpha = .05$

$\beta = .20$

$$N = \frac{\left(1.645\sqrt{.355(1-.355)/.164} + .841\sqrt{.35(1-.35)+.38(1-.38)(1-.164)/.164}\right)^2}{(.35-.38)^2(1-.164)(1-.20)}$$

$$N = 14{,}452$$

APPENDIX F: RESEARCH QUESTION 3 INTERACTION MODEL COEFFICIENTS

A modeling strategy using interaction terms allows for comparison of average marginal effects between subgroups. Multiplying Academy performance, applicant performance, and demographic covariates of interest with the line position indicator generates interaction terms. These interaction terms are included in a model with main effects and a vector of the same **k** covariates as the Research Question 2 models (listed in Table 4.2.6). A example model for 2-YR MPA is listed below:

$$logit\,[\,P(LTC = 1|X)\,] = \beta_0 + \beta_{MPA\,Q2}\,X_{MPA\,Q2} + \beta_{MPA\,Q3}X_{MPA\,Q3} + \beta_{MPA\,Q4}X_{MPA\,Q4} + \beta_{Line}X_{Line} + X_{Line} * \beta_{Line*MPA\,Q2}X_{MPA\,Q2} + X_{Line} * \beta_{Line*MPA\,Q3}X_{MPA\,Q3} + X_{Line} * \beta_{Line*MPA\,Q4}X_{MPA\,Q4} + X_{\boldsymbol{k}}\beta_{\boldsymbol{k}} + \varepsilon$$

The coefficients of interest in this model are β_{Line}, $\beta_{Line*MPA\,Q2}$, $\beta_{Line*MPA\,Q3}$, and $\beta_{Line*MPA\,Q4}$.

β_{Line} is interpreted as the average marginal effect of participating in a line leadership position on promotion to LTC for individuals with a 2-YR MPA score in quartile 1.

$\beta_{Line*MPA\,Q2}$ is interpreted as the difference in average marginal effect of participating in a line leadership position on promotion to LTC for someone with a 2-YR MPA in the second quartile compared to someone with a 2-YR MPA in the first quartile. $\beta_{Line*MPA\,Q3}$ is interpreted as the difference in average marginal effect of participating in a line leadership position on promotion to LTC for someone with a 2-YR MPA in the third quartile compared to someone with a 2-YR MPA in the first quartile. $\beta_{Line*MPA\,Q4}$ is interpreted as the difference in average marginal effect of participating in a line leadership position on promotion to LTC for someone with a 2-YR MPA in the fourth quartile compared to someone with a 2-YR MPA in the first quartile.

The *p*-values for $\beta_{Line*MPA\,Q2}$, $\beta_{Line*MPA\,Q3}$, and $\beta_{Line*MPA\,Q4}$ are from a *z*-test comparing each of the coefficients to β_{Line}. The *p*-values indicate if the effect of line is different between the groups. In this example model, since quartile 1 is the omitted quartile all of the *p*-values are for a comparison to quartile 1. By changing the omitted quartile, I am able to generate *p*-values for all quartile comparisons. These *p*-values

are listed in Table 4.3.2. Table F.1 lists coefficients for these interaction models. The *p*-values listed in Table F.1 are only for comparisons to the first quartile.

The initial step taken to answer Research Question 3 was the specification of models with interaction terms multiplying the continuous versions of the covariates with the line position indicator. An example of this type of model for 2-YR MPA is below:

$$logit\,[\,P(LTC = 1|X)\,] = \beta_0 + \ + \beta_{Line}X_{Line} + \beta_{MPA}\,X_{MPA} + X_{Line} * \beta_{Line*MPA}\,X_{MPA} + X_{\boldsymbol{k}}\beta_{\boldsymbol{k}} + \varepsilon$$

The coefficient of interest in this model is $\beta_{Line*MPA}$. This coefficient is interpreted as the change in the average marginal effect of participating in a line leadership position on promotion to LTC for a one unit change in 2-YR MPA. For example, the interpretation for the coefficient across from Line*MPA in Table F.2 is as follows: The average marginal effect of participating in a line position on the probability of promotion to LTC decreases by 3.3 percentage point for each 1 standard deviation increase in 2-YR MPA. This coefficient is not significant. None of the coefficients on the interaction terms in Table F.2 are significant. The lack of significant findings and a hypothesis that non-linear interaction effects might exist led me to the strategy of dividing covariates into quartiles and testing the effect of holding a line position on promotion for each of the quartiles.

Table F.1
Interaction Models with Line Position for Class Years 1983-95

Main and Interaction Terms[a]	*n* (Total=12,174)	Average Marginal Effect[b]	*p*-value
Models Interacting Academy Performance Covariates with Line	-	-	-
Two-Year Military Performance Average	-	-	-
Line Main Effect (1st Quartile)	93	15.1%**	.002
Line*2nd Quartile	249	-8.2%**	.000
Line*3rd Quartile	490	-6.7%**	.000
Line*4th Quartile	1,162	-11.3%**	.000
Two-Year Grade Point Average	-	-	
Line Main Effect (1st Quartile)	284	9.6%**	.001
Line*2nd Quartile	425	-4.8%**	.002
Line*3rd Quartile	551	-5.9%**	.000
Line*4th Quartile	734	-5.2%**	.001
Two-Year Athletic Merit List Count	-	-	
Line Main Effect (0 Times on Merit List)	605	7.1%**	.000
Line*1 Time on Merit List	428	-2.8%	.108
Line*2 Times on Merit List	348	.0%	.986
Line*3 Times on Merit List	302	-2.7%	.097
Line*4 Times on Merit List	311	-6.6%**	.000
Models Interacting Application Covariates with Line	-	-	-
ACT/SAT Concordance Score	-	-	-
Line Main Effect (1st Quartile)	456	3.6%	.129
Line*2nd Quartile	552	3.8%*	.012
Line*3rd Quartile	588	2.1%	.156
Line*4th Quartile	398	1.0%	.492

Table F.1-Continued

Main and Interaction Terms[a]	*n* (Total=12,174)	Average Marginal Effect[b]	*p*-value
Prior Academic Record Score	-	-	-
Line Main Effect (1st Quartile)	383	9.4%**	.000
Line*2nd Quartile	503	-6.2%**	.000
Line*3rd Quartile	497	-3.8%*	.015
Line*4th Quartile	611	-5.3%**	.001
Leadership Composite Score	-	-	-
Line Main Effect (1st Quartile)	422	4.4%	.066
Line*2nd Quartile	450	1.9%	.197
Line*3rd Quartile	518	4.0%**	.009
Line*4th Quartile	604	-1.5%	.297
Models Interacting Demographic Covariates with Line	-	-	-
Age Entry	-	-	-
Line Main Effect (Age 17)	430	7.6%**	.002
Line*Age 18	1,152	-2.9%	.129
Line*Age 19	298	-2.9%	.121
Line*Age 20	71	-9.9%**	.000
Line*Age > 20	43	-.8%	.667
Gender	-	-	-
Line Main Effect (Female)	149	-.1%	.973
Line*Male	1,845	6.2%	.082
Female Main Effect (Base Level)	1,392	-	-
Male Main Effect	10,782	14.3%**	.000

Table F.1-Continued

Main and Interaction Terms[a]	*n* (Total=12,174)	Average Marginal Effect[b]	*p*-value
Race	-	-	-
Line Main Effect (Caucasian)	1,745	5.3%**	.000
Line*Black	101	4.6%	.053
Line*Hispanic	76	-4.4%[c]	.049
Line*Asian	59	-1.3%	.573
Line*Other	13	-2.0%	.369

NOTE: p values are for a two-tailed *z*-test comparing the average marginal effects to zero
*p<.05, **p<.01

[a] Quartile indicators were created for continuous variables in order to compare well below average, slightly below average, slightly above average, and well above average groups. Each section of the table is a unique model specified with main effects for line position and the variable of interest and also an interaction between holding a line position and the variable of interest. The same set of covariates that was included in the four models in the previous section were also included, but their coefficients are omitted from the table for simplicity. The average marginal effects for the "Line" variable in each model represents the average marginal effect for the base level. For example, in the first section of the table the 15.1% average marginal effect in the column to the right of the "Line" variable represents the average marginal effect of holding a line position for individuals with an MPA score in the 1st quartile of the score distribution in the sample.

[b] For coefficients on interaction terms in nonlinear models, average marginal effects are calculated using the method recommended by Norton, Wang, and Ai (2004, p. 155).

[c] For the subgroup models results displayed in Table 4.3.1 the coefficient for line position for the Hispanic subgroup was 6.7% which was **greater** than the coefficient for line position for the Caucasian subgroup (5.4%). The confidence interval around this coefficient value of 6.7% ranges from -6.5% to 19.8%. The *p*-value listed in this table indicates the coefficient for the interaction term between Hispanic and line position is significantly **smaller** than the interaction term between Caucasian and line position. The fact that the coefficient for the Hispanic subgroup is greater than the coefficient for the Caucasian subgroup in one model and smaller in this model is the result of the subgroup model allowing all covariates to vary within the Hispanic subgroup while the interaction model only includes an interaction between the Hispanic indicator and participation in a line position. Interactions between the Hispanic indicator and all of the other covariates were not included in the models for this table.

Table F.2
Interaction Models with Line Position Using Continuous Versions of Predictors for Class Years 1983-95

Main and Interaction Terms	Average Marginal Effect[b]	p-value
Model Interacting Military Performance Average with Line	-	-
Line Main Effect	43.5%**	.000
Line*MPA[a]	-3.3%	.187
MPA Main Effect[a]	6.2%**	.000
Model Interacting Grade Point Average with Line	-	-
Line Main Effect	13.4%	.081
Line*GPA[a]	-1.2%	.306
GPA Main Effect[a]	.7%	.291
Model Interacting ACT/SAT Concordance Score with Line	-	-
Line Main Effect	12.7%	.452
Line*ACT/SAT Concordance Score[a]	-.5%	.993
ACT/SAT Concordance Score[a]	1.1%*	.048
Model Interacting Prior Academic Record Score with Line	-	-
Line Main Effect	14.1%	.121
Line*PAR[a]	-1.1%	.950
PAR Main Effect[a]	1.3%*	.013
Model Interacting Leadership Composite Score with Line	-	-
Line Main Effect	19.5%	.076
Line*Leadership Composite[a]	-1.5%	.966
Leadership Composite Main Effect[a]	.7%	.196
Model Interacting Selection Panel Rating Score with Line	-	-
Line Main Effect	1.1%	.903
Line*Selection Panel Rating Score[a]	.6%	.983
Selection Panel Rating Score Main Effect[a]	-.6%	.242

Table F.2-Continued

Main and Interaction Terms	Average Marginal Effect[b]	p-value
Model Interacting Candidate Fitness Assessment Score with Line	-	-
Line Main Effect	8.5%	.227
Line*CFA[a]	-.6%	.984
CFA Main Effect[a]	-1.3%*	.014
Model Interacting Age with Line	-	-
Line Main Effect	29.4%	.225
Line*Age	-1.5%	.216
Age Main Effect	-1.2%	.086

NOTE: *p* values are for a two-tailed *z*-test comparing the average marginal effects to zero *p<.05, **p<.01

[a] The average marginal effect for this term is multiplied by the value of 1 standard deviation for the variable interacted with Line.

[b] For coefficients on interaction terms in nonlinear models, average marginal effects are calculated using the method recommended by Norton, Wang, and Ai (2004, p. 155).

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